Effet de la libéralisation du commerce des services en Afrique

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EFFECT OF SERVICES TRADE LIBERALIZATION IN AFRICA

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La faculté n'entend donner aucune approbation ou improbation aux opinions émises dans cette thèse. Ces opinions doivent être considérées comme propres à leur auteur.

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ACRONYMS

ACP	African, Caribbean and Pacific Group of States
BEAC	Banque des Etats de l'Afrique Centrale
COMESA	Common Market for Eastern and Southern Africa
CEMAC	Central African Economic and Monetary Community
EAC	East African Commission
EBA	Everything But Arms [Agreement]
ECOWAS	Economic Community Of West African States
EPA	Economic Partnership Agreements
EU	European Union
FDI	Foreign Direct Investment
FTA	Free Trade Agreement
GDP	Gross Domestic Product
GNP	Gross National Product
IMF	International Monetary Fund
LDC	Least Developed Country
MFN	Most-Favoured Nation
NTB	Non-Tariff Barrier
ROW	Rest of World
SACU	South African Customs Union
SADC	South African Development Community
WAEMU	West African Economic and Monetary Union
UNCTAD	United Nations Conference on Trade and Development
WB	World Bank
WTO	World Trade Organisation

CHAPTER I
INTRODUCTION AND OVERVIEW

1 Introduction

Traditionally regarded as non tradable, services have been excluded for a long time from the multilateral trade negotiations and have benefited from little consideration in the economic literature. A paradoxical situation insofar, services account for the largest share of value added and employment in most developed countries (and increasingly in developing countries). However, the introduction of services trade issues in the framework of multilateral negotiations with the adoption of the General agreement on Trade in Services (GATS) during the Uruguay round in 1993, followed by the increasing tendency of considering services as a full part of any trade arrangements at regional as well as bilateral level have raised the interest of services trade issues in the last two decades.

This is epitomized by the increase in studies covering different aspects of services trade, including notably the measurement of services liberalization and the impact of services liberalization[1]. However, because of the abstract nature of services and the lack of data, these studies have been limited in terms of regions coverage focusing on OECD countries[2]. Assessing services trade issues in developing countries in general and African countries in particular received little attention, despite the urgent challenges of competitiveness and productivity raised by the deficit of services in these countries. This thesis contributes to fill this gap, by focusing on African countries.

Noting that the strengthening and the extension of the General trade agreements on trade in services (GATS) constitute an important component of the WTO's current multilateral trade negotiations, while privatization operations are continuing in developing countries, the aim of this thesis is to assess the impact of services trade liberalization in Africa.

Our analysis will be focused on two services: financial and telecommunications. This choice is dictated by a) the possibility to convert the qualitative information on sectoral liberalization and regulatory provisions into quantitative variables; b) the possibility to rank cross-country

[1] See the set of studies undertaken in this way by the common project common of the Australian Productivity Commission and the Australian National University in various sectors of services including notably: telecommunications (Warren, 2001), bank (McGuire et Schuele, 2001), maritime transport (McGuire et al., 2001), education (Kemp, 2001), distribution (Kalirajan, 2000) and professional services (Nguyen Hong 2000).
[2] See OECD survey on services trade studies on developing countries by Nielson and Taglioni (2004).

differences in the liberalization and regulatory provisions along a meaningful scale; c) the availability of historical information for a long enough period of time; and d) the existence of sufficient variability over time and across African countries[3].

Beyond the data exigencies, the choice of telecommunications and the financial sector relies specially on the potential virtue of liberalization in these sectors in terms of price reduction, employment creation and improvement of the competitiveness and productivities (see Winter et al. 2001).

In terms of price reduction

Theoretically, liberalization is likely to prompt a decline in the price: first, the rationalization gains through the exploitation of economies of scale would lower costs of production. Secondly the introduction of competition would provide service providers with incitation to reduce their margin, and therefore to lower consumers prices.

In terms of employment creation

The liberalization of trade in services is likely to create direct jobs through the entry of Foreign Direct Investment (SDIs) and technological innovation that allow the development of existing activities as well as the creation of new opportunities. Thus, gains in products varieties that have accompanied the liberalization of the telecommunication sector in Africa have led not only to job creation by main telephone operators, but also to the emergence of new activities related to improvement of quality of telephony services and the introduction of new technology like internet (e.g. cyber café and call-center) [4]. In the Cameroonian financial sector, the liberalization of activities related to money transfer, combined with the expansion of mobile phone and internet coverage has resulted in the emergence of a new business of money transfer between cities and villages, analogous to the "Western Union" mechanism at international level[5].

In terms of competitiveness and productivities

[3] The financial sector indicators have been provided by the survey of IMF on regulation and liberalization provisions on African financial sector in 1987 and 1997. Concerning telecommunications, the UIT- World Bank survey on basic telecommunications from 1995 to 2004 provide data on the telecommunications number of operators and the statute of the regulatory authority. But concerning the multilateral liberalization, we used the WTO source to collect information on the countries members' "commitments to liberalize" and to adopt the "reference paper".

[4] According to the report of French Embassy in Cameroun (Mission Economique française, 2006), in 2006, 400 people were employed by cyber café, in major Cameroonian cities, while there nothing before 1996.

[5] While this activity has started in Cameroon after 2002, a survey in 2007 by the local newspaper "Le messager" has identified 10 agencies dealing with transfers business with coverage of at least the five largest cities.

More than goods, services are essential inputs to production and marketing of other goods and services. Thus, a liberalization contributing to an improvement in their quality and price would participate in the competitiveness and productivity of the economy as whole. An efficient and well-regulated financial sector leads to an efficient transformation of savings into investment, ensuring that resources are deployed where they have the highest returns and an increased variety of financial products allows a better risk sharing in the economy (Demirguc-Kunt et al. 1998). Levine (1997) identifies five major functions that financial systems perform which help in minimizing transaction costs and improving the allocation of real resources and then contributing to growth[6].

In the case of Telecommunications, the expansion of the networks generates cost savings to other markets by reducing transaction costs, improving the flow of information and increasing arbitration abilities (see Leff, 1984). The more widespread availability of mobile phone at reduced costs are often touted as a blessing for Africa, by increasing mobility, broadening trade networks and facilitating searches for employment, all of which are elements conducive to higher levels of economic growth[7]

Beside the input role, services also assume an essential function in modern economic development, in coordinating the production processes needed to generate (differentiated) goods and to realize scale economies (See Francois 1990). For instance, the development of NTIC (telecommunications) and the facilitation of financial cross-border transaction make it possible for firms to adopt flexible structures and locations, contributing to the evolution of complex and large organizations in order to improve the productivities (See Wellenius, 1977).

Nevertheless, several factors in the African context strongly suggest a risk of the absence of gains or misdistribution as a result of liberalization. Since liberalization in Africa was preceded by state monopolies largely benefiting from subsidies on prices and employment, there is a possibility that the total disengagement of the state through privatization could lead to a direct effect of higher prices (particularly in remote areas) of services and lead to jobs losses at least in the short term. Another risk in respect of liberalization effect relates to the distribution effect. It is not clear that IDEs services have an overall effect particularly favorable for the employment

[6] These functions include facilitating the trading of risk, allocating capital to productive uses, monitoring managers, mobilizing savings through the use of innovative financial instruments and lastly, easing the exchange of goods and services.

[7] In fact, the World Bank (2006) notes that most of the recent growth in the telecommunications market has involved mobile phones outnumbering fixed ones. In Nigeria, for instance, the number of mobile subscribers jumped from 370,000 in 2001 to 16.8 million in September 2005.

of the poor in the short-term in Africa, as IDEs are worn by a logic of innovation and progress, which requires a workforce rather heavily qualified[8].

The actual effect of liberalization depends, in large part, on the willingness and capacity of the state to conduct a genuine policy for losers, in using notably the additional resources generated in the process and undertaking appropriate regulation to frame the private operators' activities. However, in the African context, where states have often faced severe fiscal constraints and where the power of civil society remains very low (weakness of labor unions), the allocation of additional resources made available by liberalization is highly uncertain. Similarly, the weakness of some African states compared to powerful multinational companies operating in services, could leave oneself perplexed about the ability of government to impose binding regulations. The net effect of services liberalization is therefore an empirical question.

Our thesis raises three main questions: (1) is there any problem of market power in African services market, and what is the role of services liberalization and regulation in improving this situation? (2) To what extent could the services performances (i.e. price reduction and services access) contribute to strengthening growth in Africa? (3) Is there any expectation from services liberalization in term of poverty reduction? The following chapters provide solutions to each of these questions chronologically.

Before, it would be instructive to present in this introductory chapter some stylized facts and concepts characterizing trade in services: the next section shows the evolution of trade in services and its place in world economy. The third section provides an update on some important concepts related to services trade and services negotiations. The fourth section provides a brief overview of indicators used to measure services trade liberalization. The fifth section provides a summary of the thesis. The final section concludes by some policy recommendations and research perspectives.

2 Evolution of commercial services in international trade and growth

[8] Based on survey data from the World Bank (1990-1993) on five African countries (Cameroon, Ghana, Kenya, Zambia and Zimbabwe), a study by Willem and Morrissey (2001) notes that even if Foreign firms pay more than others (20 to 40%), they are also more beneficial to people qualified (in terms of payroll). The authors explain this bias wage on the one hand, the technology-intensive activities of these firms and by the ability of qualified persons to demand a better sharing of pensions.

Thanks in particular to the new supports and means of transactions offered by innovations in new technologies of information and communications, the services trade has been as highly dynamic as that of goods during the two last decades. The report of WTO on the international trade (OMC, 2004) point out that, since 1985, the trade in services increased at the same rate as that of goods at a rate of 6%. During the same period, the contribution of services to the whole international trade has been maintained at 20%; that is to say a value of 1763 billion dollars in 2003 (See table.1 column (1)) [9]. The main services offered at the international level are notably transport, travel and "other services" in particular made up of communications, finances and others services (See OMC, 2004).

However, like in the case of goods, the flow of services trade is very unequally distributed among the various parts of the world (See table.1 column (2)). Thus in spite of a sustained high growth in almost all the areas of the world during the last years, the developed countries (North America and Western Europe) represent alone more than 75% of the international trade in services. This figure reflects the importance of the services activities in these countries where they contribute to more than 30% to the foreign trade and generate more than 70% of the value added and employment.

Table 1. Evolution of commercial services trade (exports) in the world in 2003

	Value (Billon of Dollars)	**Share in the total World**	**Annual Variation in percentages**				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	2003	2003	1990-95	1995-00	2001	2002	2003
World	**1763**	**1**	**9**	**4**	**0**	**6**	**12**
United States	282	16.0	8	7	-3	1	4
Latin America	60	3.4	8	6	-3	-4	6
European Union (15)	802	45.5	7	4	3	10	16
Developing Countries:	377	21.4	14	5	0	5	6
Africa	36	2.0	7	3	1	3	
South Africa	6	0.3	6	1	-7	0	26
Asia	345	19.6	15	3	-1	8	6
Developing countries from Asia	249	14.1	18	4	2	9	5

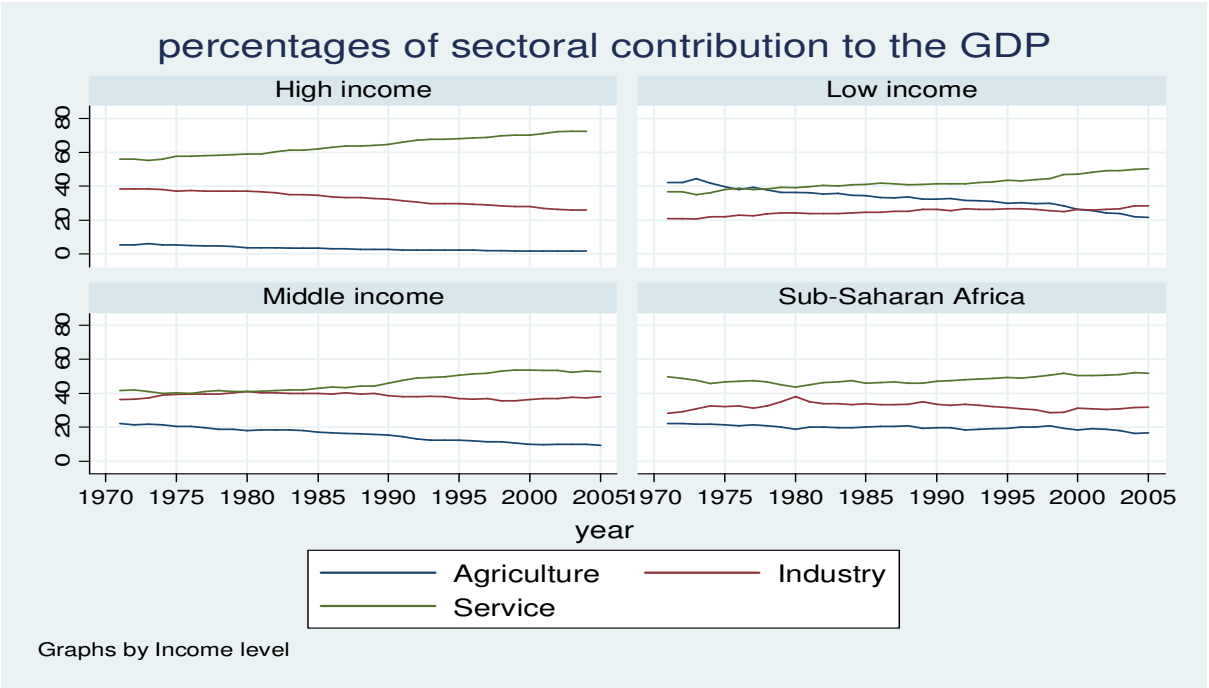
Source: (OMC, 2004)

[9] In addition, because of intangible nature of majority of the services whose transactions require a bringing together between the supplier and the consumer, the immense share of their exchanges (80%) are carried out at the domestic level (Karsenty, 2000) and are thus not considered in the figures extracted the balance of payments above..

Nevertheless, the progression of the trade in services was more important in developing countries thanks to Asian developing countries which, as evidenced the table, carried out the highest and most constant growth of the last ten years, to reach 249 billion dollars of exports in 2003, which represent 14.1% of the world total.

However, Africa remained at bay. Even if the growth of its exports of services was higher than that of the goods, it is by far lower than that of the rest of the world, and that of the whole developing countries. This portrays a strong marginalization of the continent whose exports of services estimated in 2003 at 36 billion dollars, accounts for hardly 2% of the world total.

FIGURE 1. **Contribution of service to global GDP**



Source: author construction using data from WDI (2005)

This African marginalization has removed from the continent the main engine of the word "growth" during the last four decades. The figure 1 presents the contribution of services to the total value added in Africa, and in three groups of countries based on World Bank income categories (Low income, middle income and high income) on the period from 1970 to 2005.

It appears that the countries constituting each of the three categories of income have benefited on average substantial increase in the contribution of service from 12 points in the case of low

income to 20 points for high income[10]. However, when the African countries trend is isolated, it reveals, on average, no change in the share of service contribution to GDP since 1970[11]. The services are nevertheless an essential component of the African economies, as they represent more than 20% of the foreign trade and generate from 20 to 70% of the value added according to the countries considered.

3 Concepts of services and services negotiations

3.1 Services classifications of GATS and relevant trade barriers

The GATS of Uruguay Round fixing the general framework of the liberalization of the trade in services, distinguishes 155 types of services and 4 modes of supplies**:** Telecommunication and financial services are mostly concerned with modes 1 to 3. Mode 1 (cross-border supply) covers, for instance, a service of financial transfers abroad and incoming international phone calls: A telephone operator in, say, Cameroon, "exports" a cross-border service by allowing foreign suppliers to terminate international calls in its territory[12].

The Mode 2 refers to the “consumption abroad”, and corresponds to the case where an individual moves abroad in order to consume a service. Thus, commitments that might affect the mode 2 fall mostly in the framework of the tourism policy rather than sectorial measures for telecommunications or finance industries. However, services such as international simple resale, call back and mobile roaming may be considered mode 2 (consumption abroad), or at least a combination of modes 1 and 2. Businesses, as opposed to individuals, may also "consume" abroad when they purchase leased lines in other markets or use international capacity trading to buy minutes from a capacity wholesaler in another market. Hence, limitations on modes 1 and 2, when they exist, often restrict incoming traffic from "bypassing" the facilities-based operator, e.g. when new forms of services, such as voice resale and voice over internet, are not yet permitted.

[10] The high income has seen their service share moved from 58% in 1970 to 78% in 1980. The equivalent figures are 40% to 58% for middle income and 38% to 50% for low income.
[11] The contribution of service to GDP in Africa has been the same in 2005 and 1970, 50%.
[12] Telecommunications services can also be traded cross border via satellite and leased lines (e.g. the internet).

Mode 3 (commercial presence) refers to the establishment of foreign-owned subsidiaries to deliver telecommunications or financial services. Mode 3 commitments may permit foreign bank entry to supply the full gamut of financial services, or may permit their participation in only certain services. With the disengagement of governments in the services sectors including telecommunications and financial sector in Africa in the mid-1990s, foreign companies provided a large part of the necessary investment and technological innovations. For example, almost 90 per cent of firms in mobile telephony market are controlled by foreigners (ITU, 2004). In the monetary zone of the communities of central African countries (CEMAC), say zone of franc, more than 65% of bank actives are controlled by foreign banks (see BEAC, 2008). Typical restrictions on mode 3 refer to foreign ownership limitations, limits on the number of suppliers (e.g. monopolies or duopolies) and connectivity policies in relation to networks used to supply closed user group services.

The mode 4 refers to « temporary movement of natural persons» abroad in order to supply the services. Discussions on mode 4 (temporary movement of natural persons) are more concerned with a number of general issues, such as visa policies, than with sector-specific restrictions. Essentially negotiations are based on the following four categories of physical persons (Intra–Corporate Transferees (ICT), Business visitors (BV), Contractual service suppliers (CSS), and Independent Professionals (IP)) who are mainly related to commercial presence (excepted the IP). A typical request of developing countries in respect of this point is the creation of categories de-linked from mode 3 and the "*Substantial improvements*" of the coverage of existing categories by allowing less qualified persons and more long time journeys[13].

3.2 Services negotiations: GATS rules

All WTO Members are subject to the general provisions of the GATS, notably various transparency obligations. The GATS sets a method of negotiation for all services (including telecommunications and finance) based on the system of requests and offers (commitments). The negotiations are based on the limitations on market access, national treatment (non-discrimination rule) and other restrictive practices of trade in services. For each type of service, the negotiations must cover all or only part of the four modes of supply. Each commitment subscribed is concerned only by sectors and modes of services specified "positive list", and will

[13] See Communication from Argentina, Bolivia, Brazil, Chile, Colombia, India, Mexico, Pakistan, Peru, Philippines, Thailand and Uruguay at WTO, document **TN/S/W/31 (**18 February 2005).

benefit all WTO members (under MFN) excepted special exemption that should not exceed 10 years “negative list". Beyond the general provision, each member is bound by its own schedule, which may contain commitments on particular sectors or modes of services.

In the case of telecommunication, commitments may contain both value-added telecommunications services (mostly made during the Uruguay Round) and basic telecommunication services (mostly negotiated after the Uruguay Round). A range of WTO Members with commitments on basic telecommunications made additional commitments on regulatory disciplines. Most of them did so by committing to some or all aspects of the so-called "Reference Paper". The Reference Paper contains a set of principles covering regulatory matters such as competition safeguards, interconnection guarantees, transparent licensing processes, and the independence of regulators.[14] By February 1997, 72 governments have submitted schedules on basic telecommunications. Of these, 59 committed to the Reference Paper in whole or with few modifications.

Financial services commitments have been negotiated through the “interim agreement” (negotiated in 1995 and involving 76 countries) and annexed on the second protocol of GATS, as well as the fifth protocol (negotiated in 1997 by 97 countries including those participated to interim agreements) and entered into force in 1999. At the starting of the current Doha negotiation, 104 countries have subscribed specific commitments on the financial services.

Globally, the African countries have been little involved in the services liberalization process, as only fifteen and twelve of them have subscribed to a commitment on telecommunications and financial sector respectively[15]. This reticence with respect to a liberalization of trade in services on a global scale seems to reflect two major concerns[16]. First, these countries generally consider that any negotiated liberalization of such exchanges will produce largely unbalanced results in favor of the North because of the difference in ability to negotiate (see Cadot et al, 2007). In addition, developing countries are concerned by the implications of the control of key service sectors by multinationals in terms of national security and culture. Thus, the telecommunications

[14] See Reference paper available at: http://www.wto.org/english/tratop_e/serv_e/telecom_e/tel23_e.htm.
[15] However, the absence of commitments does not necessarily imply that these countries do not allow for financial services trade (see Marion and Vennes, 2006). For example, banks with French ownership detained more than 60 percent of market share in the Monetary Community of Central Africa (CEMAC) that so far made no commitments under GATS.
[16] Another important factor relies on the LDC guidelines on services, negotiated among WTO Members, that permit LDCs to opt out (i.e. make no GATS offer at all) if they so choose.

industry in Gabon, have been for long time part of the Ministry of Defense, due to their "particular strategic importance" (see Ebang and ILEAP, 2005).

4 Measure of services trade liberalization[17]

Services trade barriers essentially consist of regulations limiting the access of foreign services providers to the domestic market or subjecting them to less favorable treatment than local providers. The methodologies to measure the degree of trade restrictiveness in the services area are inspired by approaches used to characterize non-tariff barriers on goods. Qualitative data on regulations or the behavior of economic agents is transformed into a system of scores, which is then used to construct a restrictiveness index. Hoekman (1995) constructs an index rating countries according to the number of sectors and modes committed under the GATS. This index suffers from at least two shortcomings: first, it characterizes liberalization only in terms of GATS commitments, which may be quite different from reality (Chen and Schembri, 2002). Second, the same weight is accorded to each mode (and hence to each restriction), although not every mode is equally significant in each sector and restrictions are of a quite varied nature.

Recent studies proposed more elaborated indicators based on the actual regulatory framework and ignoring the GATS commitments. For instance an IMF survey conducted by Gelbard and Pereira (1999) compute for a set of 38 African countries three financial liberalization indicators including market structure, market openness and sectoral regulation. Each indicator is built as an average of scores (ranged from 1 to 100) related to a set of criteria considered as financial liberalization determinant.

In line with Gelbard and Pereira (1999) approach, the study by Mattoo et al. (2006) on telecommunications and financial services assigns a liberalization score to each country on the basis of three criteria: market structure, ownership (FDI) and independent regulator. However the Mattoo et al. (2006) study is more elaborated as they further build a single composite liberalization index by rating each component according to their presumed restrictive effects. Several studies used more sophisticated indexes examining both the quality of GATS commitments as well as the actual state of liberalization. Such approaches have been pursued by Warren (2001) on telecommunication services, Fink, Mattoo and Neagu (2002), MacGuire et

[17] This section is build from Djiofack and A Keck (2006).

al. (2000) and Kang (2000) on maritime transport services, MacGuire (2002) on financial services, Kemp (2000) on education services and Kalirajan (2000) on distribution services.

In this study, we will adopt the Gelbard and Pereira (1999) indicators to capture the liberalization in financial sector. For the telecommunication service, we will consider three aspects of liberalization: the unilateral liberalization (competition) measured by the number of operator in telecommunication market; the multilateral liberalization, measured by the quality of GATS commitments and the UIT indicator of the regulatory authority autonomy.

5 Chapter outline and main results

Chapter 2, ***"Determinants of Competition in a Context of Services Trade Liberalization: Analysis of Market Power of Firms in African Telecommunications Industry",*** aims to estimate the market power and its sources in the African telecommunications industry.

Particularly, we are interested in the role of the following factors in attenuating market power in telecommunication industry: (1) the services trade liberalization (number of operators allowed in each segment); (2) the quality of regulation including, the effectiveness of regulations at sectoral level (autonomy and experiences of regulatory authority) and the quality of governance at national level (quality of country institutions); (3) the organizational structure of telecommunications industry captured by the multimarket contact effect (reflecting the situation of two operators whose parent companies would be competing in more than one market).

Study adopts the "multiple-indicator multiple-causes" (MIMIC) model. The intuition of the MIMIC approach is to represent the market power as a latent variable, which has causes and effects that are observable. Thus there are two kinds of observed variables in the model, "causal" variables and "indicator" variables, which are connected by a single unobserved latent variable. This approach, despite its own drawbacks, circumvents some limitations of the conjectural variation approach. These include notably the potential problem of specification related to the subjective choice of non linear form of demand function indispensable to identify market power parameters in NEIO models.

The empirical estimate is based on aggregate price and quantity biannual data from 30 African countries between 1996 and 2003. Three main results emerge from our estimates: First, the

African telecommunication industry faces a strong and significant market power, which maintains the continent prices above the competition level. Second, beyond the increasing in penetration which contributes to attenuate the market power, three policy factors seem also to be affecting it negatively: the unilateral (domestic) efforts in term of liberalization (increasing in number of operators) as well as strengthening sectoral regulation, and the multilateral subscriptions of commitments to liberalize in the framework of the GATS at WTO. Third, it appears, as evidenced by Parker and Roller (1997), that multimarket contact of telecommunications operators is an important factor explaining the cooperative pricing behavior.

Chapter 3 ***, "Impact Of The Liberalization Of Trade In Services On The African Growth: Case Of Telecommunications And Financial Services* ",** is concerned with assessing the impact of services trade liberalization on economic growth performances. We assessed the indirect linkage between trade liberalization in financial and telecommunications services and income growth, relying on a causality chain model based on Francois and Eschenbach (2002) and Bayraktar and Wang (2006). This includes the following three stage of causation: (1) services trade liberalization contributes to reduce the concentration in market structure, (2) which reduces market power and then contributes to the sectoral performances, (3) which in turn encourages higher economic growth.

Our empirical assessment for the telecommunications services is based on 30 South Saharan African data from 1995 to 2004. As far as the financial services are concerned, the data cover 37 South Saharan African countries for the period from 1980 to 2000. The estimates, using the 3SLS, point to mitigate results. In telecommunications sector, the services trade openness, as measured by the country commitments in the framework of General Agreements of Trade in Services (GATS) at WTO, shows no correlation with the competition level (number of operators). However the level of competition has a strong effect on telecommunications services accessibility, which in turn influences significantly income growth.

In the case of the financial sector, trade liberalization, as measured by the openness of cross-border operators and operations (See Gelbard et al, 1999), emerges to be a strong determinant of market competitiveness, as measured by the level of concentration. However, the level of competition in the financial market shows no significant link with the sectoral performances whatever, the later is measured by the level of credit to private sector or by the interest rate

spread. As the last stage in the Francois et al. causality chain, the sectoral performances indicators emerge as strong determinants of income growth.

As an important difference with the telecommunications sector, the financial performances effect on growth seem to be correlated to the development level, among Africa countries, the less developed countries enjoying the higher gain.

There is, nonetheless, no evidence of complete causality chain of Francois et al, the only recurrence being the positive effect of sectoral performances and the growth, whatever the services considered.

Chapter 4, *"**Impact of the Liberalization of Trade in Services on Africa: Case of Telecommunications Services in Cameroon*** ", aims to assess, the impact of telecommunications liberalization on poverty using a combined macro-micro simulation model. Based on Cameroonian economy, the analysis consists to link the output of CGE model simulations to households' database, in order to compute poverty indicators.

The CGE model follow the framework set in Rutherford et al (2005) and Konan et al (2006) and considers two channels of liberalization effects: the productivity effect and the markup effect. However, two contributions have to be underlined:

First, instead of modeling productivity gain through the only variety effects, we model the overall productivity gains occurring from trade in services. This is done by introducing the level of penetration, as input of global productivity of factors (GPF). The penetration is based itself on the level of liberalization (number of operator). The two elasticities characterizing these relationships have been estimated in the chapter 2, using a model of simultaneous equations, estimating on the one hand, the effects of penetration on growth and on the other hand, the effects of liberalization on the penetration. Our approach allows capturing other sources of productivity gains than variety effects, which can be substantial in the case of trade in services.

Second, instead of modeling the market power (markup) through the Lener equilibrium (profit maximization), we adopt the Eastman-Stykolt (1960) approach (see Warren (2000) and Konan et al (2002)). The Eastman-Stykolt approach consists for producer, to impose a surplus (representing the markup rate) over the average cost. The markup has been estimated in an

econometric model, allowing determining the market power and its elasticity with respect to the service liberalization indicator (number of operators).

The micro module of the analysis uses the Cameroonian households income survey data of 2001 (ECAM II), and is based on the accounting micro simulation approach developed in Chen and Ravallion (2003).

Our results show that liberalization contributes to reduce poverty in Cameroon. The attribution of a supplementary license in the mobile segment of telecommunications would lead to a decrease of poverty incidence by 1.76% on average. It appears, as in Rutherford et al (2005) and Konan et al (2006), that the main gain procured by services liberalization are generated by productivity effects, even if the markup effect remain positive.

6 Conclusions and policies recommendations

Based on telecommunications and finance, this thesis analyses the effects of unilateral and multilateral liberalization of trade in services, on the sectorial performance (access to services and price), growth, macro-economic indicators and poverty.

An examination of the legal framework reveals that the telecommunications market in Africa ranks among the most opened and having the highest level of competition in the world. Thus, the percentage of countries having now a monopoly in mobile telephony has decreased from 70 in 1995 to 25 in 1999 and less than 10 in 2004. If deregulation was long awaited in fixed telephony, the process has been accelerated in the last years. While 97 per cent of operators in 1998 were still exercising under the monopolistic structure, this share has rapidly declined to 60 per cent in 2002 and 44 per cent in 2004; the same level as that of other developing countries.

The same pattern is observed in the case of financial services where the process of liberalization began in the 1980's, earlier than that of telecommunications. Thus, an IMF survey (see Gelbard and Fereira, 1999) showed that the percentage of African economies considered as opened moved from 40% in 1987, to around 68% in 1997. This same evolution is observed concerning the bank market structure. While 55% of African market structure in 1987 was considered as competitive, the figure moved to 65% in 1997.

This pattern of increasing services liberalization, result of domestic reforms undertaken under the guidance of donors, contrast with the Africa's marginalization in the process of the multilateral negotiations in the framework of the GATS at the WTO. Since the beginning of the Uruguay Round in 1986, the number of countries in Sub-Saharan Africa among the 41 WTO's members who have subscribed at least a commitment to liberalization is 13 for telecommunications and 12 for the financial sector.

While our findings may suffer from many limitations (see below), a number of policy implications can be drawn with respect to the services trade at domestic, regional and multilateral levels and the achievement of developments goal.

In the current context of multilateral trade negotiations on services, our findings provide evidence that the commitments subscribed in the framework of GATS could be a complementary factor in enhancing competitiveness in telecommunications market in Africa.

In this respect, the great disparity between the level of reforms (unilateral) and the current level of commitments (multilateral) undertaken in the framework of GATS is indicative of the huge margin that African countries possess to make new commitments on telecommunications and financial services without proceeding to additional measures at national level. Given the results of this study, African participation to multilateral negotiations should no longer be limited to the simple satisfaction of "requests" from partner countries (defensive tactics). It would be appropriate to make commitment that encourages the entry of more operators in national telephony markets and allow a strengthening of regulatory practices throughout the telecommunications market on the continent.

The strengthening of regulation can be undertaken (1) by the adoption of the reference paper of GATS, (2) the creation of sub-regional partnership possibility and (2) the requirement of a guarantee in technical assistance prior to negotiations (EPAs and the GATS).

(1) Align to the best regulatory practices at the international level

The empirical results show that the most effective instrument to enhance the performance of telecommunications is unilateral regulation. The strengthening of this framework would be ensured by the adoption of the Reference paper (RP), which provides the fullest and most complete regulatory framework on basic telecommunications. Its adoption would enable African

countries, where the regulatory framework is recent, to benefit from the best practices in their task of price control, safeguarding of competition, management of interconnection, and universal service. Although our current results do not show a link between the adoption of the Reference Paper and sectorial performances, a better mastery of RP disciplines including those relating to interconnection is likely to result in lower cost at the level of the final-user, and a more efficient use of networks, forcing the incumbents to share the economies of networking with the newcomers following the viable economically modalities.

(2) The creation of sub-regional or regional partnership possibility

It seems that a regulation with a regional perspective would be more fruitful. Our finding that the multimarket contact enhances the market power clearly advocates for current projects to establish sub-regional or regional regulatory institutions in Africa. In addition, the creation of a sub-regional regulatory space would strengthen the independence and capabilities control of the regulatory authority. It would therefore be appropriate to make prevail over the schedules of commitments the MFN exception clause for the sub-regional integration areas, in order to preserve a possibility of creating a sub-regional or regional market regulation of telecommunications[18].

(3) Requirement of technical assistance on regulation as a precondition to negotiations

Given the inexperience of regulatory bodies on the continent, and the crucial importance of an effective authority in attaining the objectives of liberalization specified above, African countries should easily enforce Article IV of GATS to obtain financing by the industrialized countries of technical assistance as a prerequisite to any participation in negotiations[19].

Researches perspectives

Our analysis suffers from important limitations. First, and most importantly, in our data set, price and quantity data are only available at an aggregate level for each country. Furthermore, the aggregate nature of the data and the resulting empirical model do not allow for differences across firm behaviors.

[18] A regulatory partnership on the base of the existing technology partnership among 45 African countries, via the RASCOM (Regional African Satellite Communications Organization) that has led to the launch in 2007 of the first pan-African telecommunications satellite, could constitute a credible departure.

[19] The Aid For Trade initiative of WTO offer an excellent framework to target this issue. Particularly the LDCs who are already engaged in the aid for trade mechanism of "Integrated Framework", could introduce the strengthening of regulatory body among the priority of their Diagnostic **Trade** Integration Studies (DITS).

Second, as all international studies, ours also suffers from the lack of available variables across a large number of countries. Thus, for our main variable of interest, market power, we may have an omitted variable problem. For example, the literature evidences that cross-ownership across cellular operators (See. Parker and Roller, 1997), the number of years that the first market entrant enjoyed a monopoly prior to competitive and services qualities, are important predictors of market power. But we did not have data to test this hypothesis in our international context.

Furthermore, this thesis failed to account for some important services for developing countries, notably services supplied through the mode 4. Various aspects of gains procured by services supplied through the mode 4 have been evidenced and include notably: (i) the potential of enhancing merchandise trade by reducing transaction costs (see Jansen et Al. 2005); (ii) the productivity improvement through imports of skills of engineering consultants or advisers to management (see Markusen and Rutherford, 2002); and (iii) the increased remittances (see Rodrick, 2001; Walmsley and Winters, 2002). Thus mode 4 constitutes the priority in "services commitments requests" by many African countries in the framework of EPAs as well as GATS negotiations[20].

However it's also one of the most controversial issues of negotiations with two main positions: on the one hand, developed countries plead for the movement of qualified persons, on the other, developing countries prefer the openness for the non-qualified. This service therefore constitutes an interesting path of future research in trade in services. Given the lack of necessary data at international level for the econometrical analysis, a credible way to undertake instructive study on this issue would be notably through a CGE model capturing both the productivity and remittances effects of movement of worker. A comparison of the scenario of the displacement of qualified worker against non qualified worker would constitute a crucial input in the formulation of negotiations positions.

[20] See the WTO members requests to the EU members available at: http://ec.europa.eu/trade/issues/sectoral/services/wto_nego

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CHAPTER II: DETERMINANTS OF COMPETITION IN A CONTEXT OF SERVICES TRADE LIBERALIZATION: ANALYSIS OF MARKET POWER OF FIRMS IN AFRICAN TELECOMMUNICATIONS INDUSTRY

1 Introduction

While it is commonly accepted that the increasing liberalization of telecommunications services with the technical progress that accompanies it have significantly improved access to services in the world during the past decade, its actual effect on the price trends, however, remains in many respects ambiguous (ITU, 2004).

This applies particularly to African countries where one decade after the launch of the first liberalization campaign, prices have not dropped (on average) in the two main segments of telephony, that is, local fixed and mobile telephone. As table 1 illustrates, between 1996 and 2004, the prices of local fixed telephone have increased; in the segment of mobile, prices are higher in the countries supposed to be in competition (more than one operator) than in those with a monopoly.

Table 1. Tests of prices averages differences

Segment	**Tests**	**Africa**	**World**
Price of mobile	**Monopoly vs. competition**	Price increase	Price unchanged
	(1997-1999) vs. (2000-2003)	Price unchanged	Price decrease
Price of local fixed	**Monopoly vs. competition**	Price unchanged	Price increase
	(1997-1999) vs. (2000-2003)	Price increase	Price unchanged

Source: author's calculation

Therefore, the process of liberalization, which consists in distributing licenses to more than one operator in the case of African countries, seems to be a non sufficient condition for the systematic decline in prices in light of the competition. While regulatory bodies and institutions of competition are particularly poor on the continent (ITU, 2004) and that operators announce significant profits particularly in the segment of mobile telephony[21], the objective of this chapter is to estimate the market power and its sources in the African telecommunications industry.

Particularly, we are interested in the role of the following factors in attenuating market power in telecommunication industry: (1) the services trade liberalization(number of operators

[21] The boom in mobile telephony in Africa has generated a financial windfall estimated at over 10 billion U.S. dollars in terms of revenues, and more than 1 billion U.S. dollars of profits (Cf. UIT 2004).

allowed in each segment); (2) the quality of regulation including, the effectiveness of regulations at sectoral level (autonomy and experiences of regulatory authority) as well as the quality of governance at national level (quality of country institutions); (3) the organizational structure of telecommunications industry captured by the multimarket contact effect (reflecting the situation of two operators whose parent companies would be competing in more than one market).

From the perspective of decision-makers (trade negotiators or policies), this analysis can provide useful insights with respect to questions such as the following: Is the consumer welfare in a particular country penalized by firms' market power? What are the potential reasons for this market power? In the case of telecommunication services, what are the sources of the market power? Does it result from the limited number of competitors, the absence of commitments in the framework of GATS, the market saturation, the multi-market arrangements, or the lack of effective regulation?

The few studies measuring the market power in telecommunications use the New Empirical Industrial Organization (NEIO) model of conjectural variation (Breshnan, 1989) and are generally based on the American economy. Our study makes contributions to the literature as follows:

First, it is to our knowledge the first attempt to estimate the determinants of market power in the African telecommunications.

Second, instead of the traditional method of conjecture variation, this study adopts the "multiple-indicator multiple-causes" (MIMIC) model, for the first time in telecommunications. Based on the models of latent variables, the MIMIC approach followed here has been developed in Joreskog and Goldberger (1975) and adapted by Mccluskey and Quagrainie (2004) to model market power in apple market in United State.

The intuition of the MIMIC approach is to represent the market power as a latent variable, which has causes and effects that are observable. Thus there are two kinds of observed variables in the model, "causal" variables and "indicator" variables, which are connected by a single unobserved latent variable. This approach, despite its own drawbacks (See section II), would circumvent some limitations of the conjectural variation approach. These include

notably the subjective choice of non linear form of demand function indispensable to identify market power parameters in NEIO models [22.]

Thirdly, instead of measuring separately market power in telecommunication segments, either on mobile segment (see Parker and Roller (1997); Nunn and Sarvary (2004)), or on fixed segment (see Ward, 1995), this study considers simultaneously the two segments. This is possible thanks to MIMIC model which implies simultaneous estimation of at least two equations that share the market power as independent variable. In this study, we consider two equations representing prices in fixed and mobile telephone segments.

Fourthly, we account for a major critics of MIMIC model, relative to the absence of economic theory to guide the specification, by presenting a theoretical framework (through the pricing rule in imperfect competition) justifying the relationship defining our latent variable (i.e. market power).

Our empirical findings suggest the existence of significant market power in African telecommunications industry, which allowed the operators to keep the price at a level higher than in the competition condition. The market power of firms seems to be mitigated by three variables: the number of operators in fixed and mobile segments, the effectiveness of regulations at sectoral level and the subscription of the commitment at WTO. It is amplified by the situation of multi-contact market.

The chapter is structured as follows. The next section describes the context of African telecommunications industry. Section 3 introduces the empirical model and its particular implementation in the international cellular context. Section 4 describes the data. The empirical findings are reported in Section 5, and the chapter ends with a discussion of the results and some concluding remarks.

[22] See Mccluskey et al (2004) for a critical analysis of conjecture variation method.

2 Telecommunications liberalization in Africa

Traditionally, telecommunication systems in Africa were run by the government. The existing telecommunications infrastructure of the colonial area was inherited by the state after its independence. Public ownership of the telecommunications sector also squared with the economic thinking of the 1970s, which favored large investments in key sectors that were expected to stimulate economic growth. Telecommunications in Africa were often under the control of a specifically created ministry or, for instance in Gabon, due to their "particular strategic importance", they were part of the Ministry of Defense (Ebang and ILEAP, 2005).

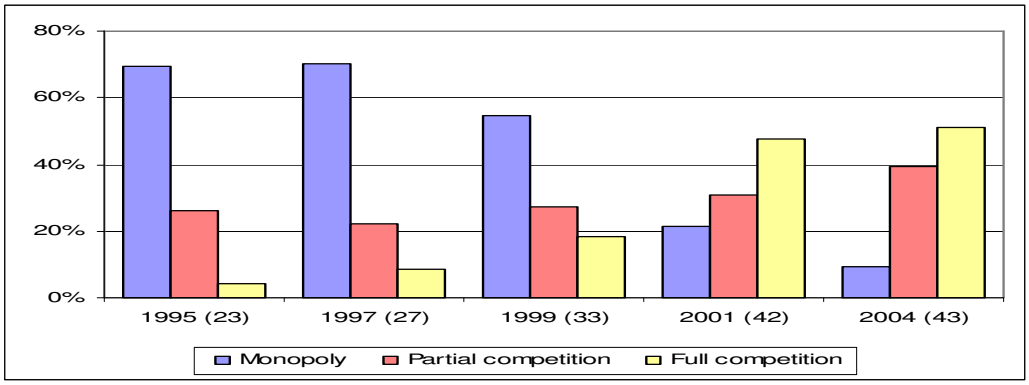
However, several factors contribute to crucial change in 1990s toward more liberalization. These include notably: (i) the need for greater efficiency of networks (see Plane, 2002); (iii) the technological innovations which amplified the costs of protection;[23] (iv) the debt crisis of the 1980s which exposed the poor management of many publicly-owned enterprises in the context of structural adjustment programs by the IMF and World Bank. These led to evolution not only at national level, but also to a coordination of efforts at the sub-regional level, like in the case of the Southern African Development Community (SADC).[24]

Figures 1 and 2 illustrate the evolution from state monopolies to a more liberal market environment in the African telecommunications sector for both fixed and mobile telephony. Between 1995 and 2004, the share of African countries maintaining a state monopoly in the mobile segment has dropped from 70 per cent to less the 10 per cent. Liberalization in the fixed-line segment has been somewhat slower, but progress has been made over the last five years. While all fixed operators in 1995 were state monopolies, this was still the case in only 44 per cent of African countries by 2004.

[23] Modern switching techniques, for instance, led to the spread of call-back services. Call-backs allow users to circumvent higher prices in the domestic market and benefit from more competitive conditions offered abroad. Voice services over the internet enable users to make international phone calls at the local rate. Technological developments of that nature increasingly undermined the view that basic telecommunications services constituted a natural monopoly. For a more extensive discussion see Doumbouya (2004)

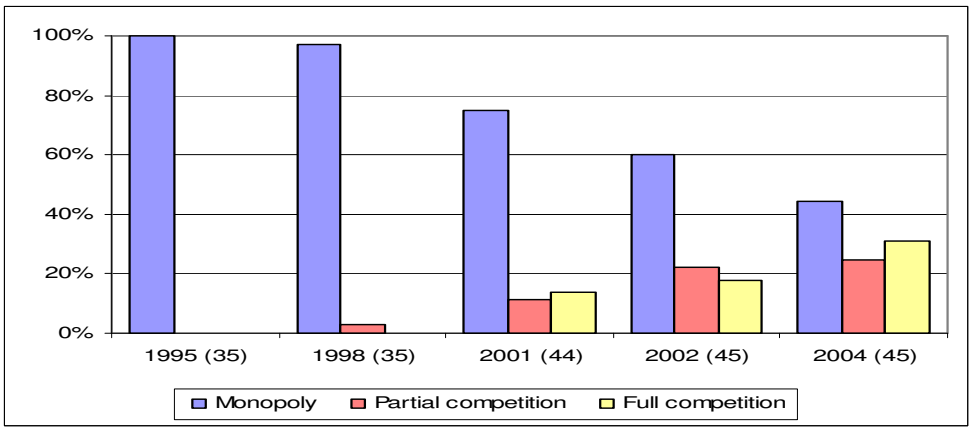
[24] The membership of the Telecommunications Regulators Association of Southern Africa (TRASA) comprises the regulatory agencies of each SADC member state. It was established to coordinate regulatory matters with the ultimate objective of promoting the establishment and operation of efficient, adequate and cost-effective telecommunications networks and services in the Southern Africa region. For more see http://www.trasa.org.bw.

Figure 1. Evolution of competition in the mobile telephony segment in Africa, selected years (per cent)



Source: authors' calculation from ITU (2004)
Notes: Partial competition: two operators; Full competition: more than two operators. Total number of countries in brackets.

Figure 2. Evolution of competition in the fixed-line telephony segment in Africa, selected years (per cent)



Source: authors' calculation from ITU (2004)
Notes: Partial competition: two operators; Full competition: more than two operators. Total number of countries in brackets.

Table.2 provides the characteristics of liberalization in individual African countries in 2004 in terms of the level of competition in different market segments - i.e. mobile telephony, fixed telephony (local, domestic long distance, international) and internet - and the status of the regulatory authority.

In short, competition in most African telecom regimes only began to be introduced around the year 2000. Yet, by 2004, Africa had gone from a continent of monopoly control over fixed services to one in which less than half of countries still maintained these monopolies. A number of governments, however, initiated duopolies in fixed telephony, rather than full competition. In mobile telephony, by 2004, the proportion of African countries maintaining

monopoly service had shrunk to around 10 percent. In practice, it is not uncommon for an African country to have 3 to 4 suppliers of mobile services. As the monopolies were opened up, foreign investment was generally permitted at one level or another, both in the former monopoly as well as in the new entrant fixed and mobile providers.

Table 2. Competition and regulation in Africa in 2004

Country	Local	Long distance	Internat ional.	Mobile	Internet	Year of creation of regulatory authority	Independence of regulatory authority	Decisions by committee (if yes, number of members)	WTO Basic Telecom Commitments
Angola	C	C	C	P	C	1999	No	Yes: 5	
Benin	M	M	M	C		2002	Yes	Yes: 5	
Botswana	M	C	M	C	C	1996	Yes	Yes: 5	Yes
Burkina Faso	M	M	M	C	C	1998	Yes	No	
Burundi	C	C	C	C	C	1997	No	No	
Cameroon	M	M	M	C	C	1998	Yes	No	
Cap-Verde	M	M	M	C	C	2004	Yes	Yes: 3	
CAR	M	M	M	C					
Chad	M	C	M		C	1998	No	No	
Congo	C	C	P	C	C				
DRC	C	C	C	C		2002	Yes	Yes: 7	Yes
Côte d'Ivoire	P	P	P	P	C	1995	Yes	Yes: 10	Yes/RP
Eritrea	M	M	M	C	C	1998	No	No	
Ethiopia	M	M	M	M	M	1996	Yes	No	
Gabon	M	C	C	C	C	2001	Yes	Yes: 6	
Gambia	M	M	M	P	C	2004	Yes	Yes: 6	Yes
Ghana	P	P	P	P	C	1997	Yes	Yes: 7	Yes/RP
Guinea	P	P	P	P	C	1992	No	No	
Guinea-Bissau	M	M	M	P	C	1999	Yes	Yes: 3	
Kenya	P	P	P	P	C	1999	Yes	Yes: 11	Yes/RP
Lesotho	P	P	P	C	C	2000	Yes	No	(value added only)
Liberia	P	P	C	C					
Madagascar	M	M	C	C	C	1997	Yes	No	
Malawi	M	M	P	P	P	1998	No	Yes: 8	
Mali	P	P	P	P	C	1999	Yes	Yes: 3	
Mauritius	C		C	C	C	2002	Yes	Yes: 7	Yes
Mozambique	M	M	M	C	C	1992	Yes	Yes: 5	
Namibia	M	M	M	M	C	1992	Yes	No	
Niger	M	M	M	C	M				
Nigeria	C	P	P	P	C	1992	Yes	Yes: 9	Yes
Rwanda	C	C		C	C	2001	Yes	Yes: 7	
S. Tomé & P.	M		M						
Senegal	C	C	C	C	C		Yes	No	Yes/RP
Seychelles	P	P	P	P	P				
Sierra Leone	M	M	P	C	P				
South Africa	C	C	C	P	C	2000	No	Yes: 7	Yes/RP
Swaziland	M	M	M	M					
Tanzania	M	M	M	C	C	1994	Yes	Yes: 7	
Togo	P	M	P	P	C	1998	Yes	Yes: 7	
Uganda	P	P	P	P		1997	Yes	Yes: 7	Yes/RP
Zambia	M	M	M	P	P	1994	No	Yes: 8	
Zimbabwe	C	P	P	C	C	2000	Yes	Yes: 7	(value added only)

Source: authors' calculation from ITU (2004)
Note: M: Monopoly; P: Partial competition; C: Full Competition; and RP: Reference Paper.

Formal liberalization of non-facilities based telephony, such as international simple resale and voice over Internet calls, has yet to take hold in Africa, but most countries have now opened up value-added services, such as e-mail and data base access, to competitive forces. In the course of the post-2000 liberalization, African countries have been able to draw on the work of regional and international telecom organizations and secure aid to hire regulatory experts. As a result, the new regulatory frameworks put in place tend to be largely consistent with notions of best practice in the sector, as well as the WTO Reference Paper. Countries are moving towards greater autonomy to the authority of regulation. Thus, in 2004, over 77 percent of African countries were equipped with a separate regulatory authority of the traditional operator and supposedly autonomous in their decision making.

Thirteen African countries committed at WTO to market access for foreign telecom suppliers, through agreements of Uruguay round in 1993 and on basic telecommunications in 1996. In the context of the Uruguay Round (1986-1994), six African countries committed to liberalize. For example, Nigeria had committed to open its mobile markets and Lesotho, Nigeria, and Zimbabwe had committed on value added services.

WTO negotiations on basic telecommunications (in 1996) came too early for more than a handful of African governments to contribute. As figures 1 and 2 above show, most governments began liberalizing well after the WTO talks ended in early 1997. This is why the WTO commitments reflect so little of the liberalization Africa has accomplished to date. Seven governments committed in the basic telecommunications negotiations (Côte d'Ivoire, Ghana, Kenya, Mauritius, Senegal, South Africa and Uganda). Like other developing countries in the negotiations, they generally took so-called "phased-in" commitments to liberalize on a given date, in line with their reform plan. Some, such as Uganda, committed to allow a duopoly. Six of them (all but Mauritius) added the Reference Paper to their commitments, thus providing a guarantee to investors of a pro-competitive regulatory regime.

In the new trade round, called the Doha Development Agenda, none of the recently liberalizing African countries has, as yet, made an offer to take on market access commitments in the telecommunications sector[25].

[25] We have presented in the chapter 1 some factors explaining the poor participation of African to the multilateral services negotiations.

3 Litterature survey

The empirical literature estimating the market power can be grouped in three main categories: (1) the approach of demand elasticities, (2) the approach of New Empirical Industrial Organization (NEIO) so-call the conjectural variation and (3) the approach of "multiple-indicators multiple-causes" (MIMIC models).

The first approach measures the degree of market power by estimating firms-specific demand elasticities. The reciprocal of the own-price elasticity, the Lerner index, provides an estimate of the percentage price markup over marginal cost for an unconstrained, profit maximizing firm. Finally, estimates of this price-cost margin provide the basis for measuring the potential deadweight loss from supra-competitive pricing. Ward (1995) applied this approach in long distance telecommunications in United State. The study concludes the existence of market power that induces a potential deadweight loss of at most 0.36% of total industry revenues during 1988-1991. However, if the method allows determining the markup, it is silent on their causes.

The second approach from the New Empirical Industrial Organization (NEIO) is more refined and more widely used. It relies on the conjectural variation and allows the estimate of conduct and cost parameters of firms, even when full data on costs is not available. The parameter of conjectural variations of the firm (i) is estimated through the standard conjectural variations equation proposed by Bresnahan (1989):

$$PX_{it} - MC_{it} = \frac{\Omega_{it}}{N_t} \frac{d\left(PX_{it}(X_{it})\right)}{d\left(X_{it}\right)} X_{it}$$

where $\Omega_{it} = \frac{d(X_t)}{d(X_{it})}$ is the expected variation of rivals output when output of firm i varies, MC is the individual marginal costs, PX is the market price, X_t is the aggregate quantity produced in the market (country), X_{it} is firm i's output, and N is the total number of firms in the market.

Assuming a non linear demand function in order to address the issue of identification (see Fageda, 2004), the model estimates the parameter of industry conduct, defined as $\lambda_{it} = \frac{\Omega_{it}}{N}$, as

the proxy of market power. The NEIO approach has been widely applied, in various industry including, the finance (Sjöberg, 2004), aviation (Fageda, 2004), electricity (Vassilopoulos, 2003) and cable television (see Rubinozvitz, 1993), but rarely in basic telecommunications. Among the few exceptions are the studies of parker and Röller (1997) and Nunn and Sarvary (2004).

Parker and Röller (1997) consider the impact of regulation policy limiting entries on the American mobile telephone market. The empirical analysis uses panel data over the period 1983-1988 covering different American telephone areas. Estimates of market power reveal that the prices are both higher than those of perfect competition and those of non-cooperative duopoly. In addition, they evidence that situations of “cross-properties” (when a firm detains shares in its competitor) and "multi-market contact» are strong determinants of the practice of non-competitive price.

Nunn and Sarvary (2004), have resumed the same pattern as that of Parker and Röller (1997) relying on 10 OECD countries. Their results indicate that a larger number of operators in a country do not seem to result in any additional effects on the power market. But the antitrust commitment of a country contributes to the decline of the market power. Finally, the authors identify the lasting of reign of a monopoly before the opening to competition as a factor contributing to the rise of the market power. The authors conclude that the market power in various countries could have two sources: the price collusion between operators and the cost of changing suppliers for consumers.

However, as pointed out Mccluskey et al (2004), the approach of NEOI considering the market power by inference has several limitations including notably the subjective choice of non linear form of demand function indispensable to identify market power parameters in NEIO models.

These criticisms have encouraged the adoption of a latent variable approach based on the so-called "model variations multiple-indicator multiple-causes” (MIMIC) presented in Joreskog and Goldberger (1975). This approach based on the assumption that even if the firm’s market power is not observable, it still has operational implications between observable variables that could be considered as indicators of behavior.

The method has its origins in the factor analysis literature of psychometrics (to analyze the quality concepts as intelligence) and are increasingly used in economic to estimate the underground economy (See Giles and Tedds, 2002; Bajada and Schneider, 2005; Dell'Anno and Schneider, 2003). The only application of MIMIC in estimating the market power is provided by Mccluskey et al (2004), who study the market of fresh apple in the United States. They represent the market power as a latent variable or index, which has causes and effects that are observable but which cannot itself be directly measured. Thus, a model is defined by connecting two kinds of observed variables ("causal" variables and "indicator" variables) with a single unobserved index. The fitted index predicted from the econometric estimation of the model is considered as an estimate of the magnitude of the market power. Our analysis adopts this approach.

However, there is a major criticism which is quite common when latent estimation procedures are used. It refers to the reliability of "causes" and "indicators" in explaining the variability of the latent variable. Smith (2002), Hill (2002) and Breuch (2005) criticize the modeling of underground economy, especially the absence of economic theory to guide the specification. This critic could also be applied to Mccluskey et al (2004) study where they assumed subjective Constant elasticities of substitution (CES) function to characterize the link between the shipment of apple and the market power in the American market of apple. To face this criticism, we present in this study a theoretical framework (through the pricing rule in imperfect competition) justifying the relationship defining our latent variable (i.e. market power).

4 Model: MIMIC model to estimate market power in telecommunications industry

Before introducing the MIMIC model to be estimated, we present the basic model of pricing rule in imperfect competition, relating the market power in telecommunications market and price.

4.1 Pricing rule in imperfect competition

The Telecommunications markets are characterized by oligopolies. To explore oligopoly interactions we use a Cournot conjectural variations model.[26] It is assumed that each firm produces a homogeneous product, faces a downward sloping demand curve and adjusts output to maximize profits, with a common market price as the equilibrating variable. The telecommunications industry is assumed to consist of N identical firms producing a collective output $X_{ct} = NX_{ict}$

Where, X_{ict} is the quantity supplied by firm i in country c and period t

Using a representative profit function yields the first order condition for each firm i in country c and period t:

$$MR_{ict} = MC_{ict} \tag{1}$$

i.e. marginal revenue MR_{it} equals marginal cost MC_{it} with

$$MR_{ict} = PX_{ict} + X_{ict}\frac{d(PX_{ict})}{d(X_{ct})}\frac{d(X_{ct})}{d(X_{ict})} \tag{2}$$

where PX_{ict} is the price of telecommunications services in firm i in country c and period t.

Given N identical firms, the equilibrium condition (1) can be written as

$$\frac{PX_{ict} - MC_{ict}}{PX_{ict}} = \frac{\Omega_{ict}}{N_{ct}\varepsilon_{ct}} \tag{3}$$

yielding the oligopoly pricing rule, with ε_{ct} being the price elasticity of demand.

(3) can be rewritten as

$$PX_{ict} = \frac{MC_{ict}}{(1-\frac{\Omega_{ict}}{N_{ct}\varepsilon_{ct}})} \tag{4}$$

$$PX_{ict} = MC_{ict}\left[1+\left(\frac{1}{(1-\frac{\Omega_{ict}}{N_{ct}\varepsilon_{ct}})}-1\right)\right] \tag{5}$$

$$PX_{ict} = MC_{ict}\left[1+\phi_{ict}\right] \tag{6}$$

[26] For an overview of alternative specifications of market structure see also Francois and Roland-Holst (1997).

Where $\phi_{ict} = \left(\frac{1}{(1 - \frac{\Omega_{ict}}{N_{ct}\varepsilon_{ct}})} - 1 \right)$ represent the mark-up and hence a measure of an operator's. It is the percentage of surplus imposes by firms on marginal cost.

For $\Omega \to 0$ or $N \to \infty$ or $\varepsilon \to \infty$, $PX \to MC$ with the quantity produced by each firm approaching the perfect competition output and rents being eliminated. Conversely, for N=1, we obtain a monopoly situation (total collusion of firms) with the mark-up corresponding to the inverse demand elasticity.

For the rest of our analysis we consider the indicator θ_{ict} to capture the market power[27] such as:

$$\theta_{ict} = [1 + \phi_{ict}] \quad (7)$$

By introducing the equation (7) into the (6), the logarithmic transformation of equation (6) yields the following structural equation:

$$\log(PX_{ict}) = \log(MC_{ict}) + \log(\theta_{ict}) \quad (8)$$

expressing the log of price as the sum of the logs of marginal cost and market power .

4.2 MIMIC model

The structural model defined above, in equation (8), is in line with the standard form of a MIMIC model since it contains an unobserved variable, $\log(\theta_{ict})$, connecting two set of observed variables, the causes variables ($\log(MC_{ict})$) and the consequences variables ($\log(PX_{ict})$). For a given country (c), we assume the firms to be identical within each segment (mobile or fixed), but different between segments. Thus, the following relationship is writing without the index of firms (i), but with the introduction of subscript (s) indicating the segments of telecommunication.

[27] We are not using this indicator as the measure of market power, it is just an intermediate stage that would facilitate the market power determination.

The model to be estimated is of the following form:

$$\log\left(PX_{ct}^{s}\right)=\lambda^{s}\log\left(\theta_{ct}^{s}\right)+\alpha_{0}^{s}+\sum_{k=1}^{K}\alpha_{k}^{s}\log\left(S_{kct}^{s}\right)+\varepsilon^{s}\ \text{ where }\ s=1,2 \qquad (9)$$

This Equation consists of a system of two supply relations, one for each segment.

ε^{s} are measurement errors with zero mean that are independently distributed over (c) and have a finite variance–covariance matrix.; α_{0}^{s} is the intercept.

S_{kct}^{s} are k's exogenous factors on the supply side explaining the marginal cost for the segment (s) in the country (c) at the time (t). α_{k}^{s} is the coefficient corresponding to the k's variable. Determinants of marginal cost consist of the output quantity $SUBR_{ct}^{s}$, the output (services) quality, $QLTE_{ct}^{s}$, the economic structure indicators and the production cost components. The production costs determinants include the energy prices index, $ENERG_{ct}$ the wage index, $WAGE_{ct}$, the interest rate and the lending price index $RENT_{ct}$. The economic structure variables include the population POP_{ct}, the density of population, $DSTE_{ct}$ and the GDP per capita, GDP_{ct}.

The log of the latent industry conduct variable $\log\left(\theta_{ct}^{s}\right)$ captures the market power. The model assumes the market power to be common in mobile and fixed segment. The market power measured in our model is therefore an average market power of telecommunication market for a given country. It can be specified in the following relationship, without index (s)[28]:

$$\log\left(\theta_{ct}\right)=\beta_{0}+\sum_{k=1}^{\mathrm{K}}\beta_{k}\log\left(F_{kct}^{s}\right)+\nu_{ct} \qquad (10)$$

Where ν_{ct} is an independently distributed random disturbance with zero mean and finite variance; F_{kt}^{s}'s are observed independents variables that determine the market power and β_{k},

[28] The market power is assumed to be the same in the fixed and mobile segment for a given market.

the corresponding coefficient. The determinants of market power $\left(F^{s}_{kct}\right)$ include variables at segment level (with index (s)), and variables at sectoral and national level (without (s)). They include, the variables of liberalizations (domestics, $LIBER^{s}_{ct}$, and multilateral, $GATSLIBER_{ct}$), the legal environment in the country $GOUV_{ct}$, the quality of regulation, as measured by unilateral regulatory authority effectiveness, REG_{ct}, and the multilateral (GATS, Reference Paper) regulatory quality $GATSREG_{ct}$. The last determinant considered is concerned with the characteristics of the market: the market saturation, SAT^{s}_{ct}, and the multimarket contact, $MMARKET_{ct}$ [29].

Substituting into (9), $\log\left(\theta_{ct}\right)$ with its value of the equation (10), gives the reduced-form equation

$$\log\left(PX^{s}_{ct}\right) = \lambda^{s}\left(\beta_{0} + \sum_{k=1}^{K}\beta_{k}\log\left(F^{s}_{kct}\right) + v_{ct}\right) + \alpha^{s}_{0} + \sum_{k=1}^{K}\alpha^{s}_{k}\log\left(S^{s}_{kct}\right) + \varepsilon^{s} \qquad (11)$$

then

$$\log\left(PX^{s}_{ct}\right) = c^{s} + \sum_{k}^{K}\varphi^{s}_{k}\log\left(F^{s}_{kct}\right) + \sum_{k=1}^{K}\alpha^{s}_{k}\log\left(S^{s}_{kct}\right) + w^{s}_{ct} \qquad (12)$$

Where the new random term is $w^{s}_{t} = \lambda^{s}v_{ct} + \varepsilon^{s}$ (13)

The constant term is $c^{s} = \lambda^{s}\beta_{0} + \alpha^{s}_{0}$ (14)

and $\varphi^{s}_{k} = \lambda^{s}\beta_{k}$ (15)

The regression of the model implies estimating a system of two equations (12) (one equation for each segment) under the constraints of equations (14) and (15). However, the identifications of all parameters in equation (12) and (10) required the imposition of cross-equation proportionality restrictions that differentiate the MIMIC model from the traditional approach of estimating structural equations (see Mccluskey et al, 2004). This consist to

[29] The choice of these factors represents a compromise between possible determinants of firm behavior and data availability for the maximum number of African countries.

normalize the industry conduct (λ^s) in order to identify the parameters of market power, β_k. This is equivalent to assume λ^s equal to one in one of the two equations. Other restriction aiming to identify β_0, required to consider the intercept of one of the two equations, α_0^s, equal to zero.

An important criticism of MIMIC model (particularly those measuring the underground economic) by Breuch (2005) is the subjective normalization of a parameter necessary to identify the latent variable parameters. Following Mccluskey et al (2004), all restrictions, including the normalization, imposed in our model would be tested using the specification test of Gertler (1988).

5 Regressions

5.1 Data descriptions and sources

The data used in this study cover 30 Sub- Sahara African countries on the period from 1996 to 2003[30] divided in four sub-periods of two years. The table.3 below provides an overview of all variables and data sources.

Table 3. Data description and sources

Variable	Variable description	Description	Source
PX_{ct}^s ; $s = 1$	**Price mobile**	Costs of 3 minutes call from one mobile to another; annual bill of average subscriber	ITU
PX_{ct}^s ; $s = 2$	**Price local fixed**	Costs of 3 minutes call from local fixed line; annual bill of average subscriber	ITU
$SUBR_{ct}^s$; $s = 1$	**Mobile output**	Number of Mobile subscribers	ITU
$SUBR_{ct}^s$; $s = 2$	**Fixed output**	Number of Fixed line subscribers	ITU
$QLTE_{ct}^s$; $s = 1$	**Mobile quality**	**share digital subscribers**	ITU
$QLTE_{ct}^s$; $s = 2$	**Fixed quality**	**share of fixed calls failed**	ITU
SAT_{ct}^s ; $s = 1$	**Penetration mobile**	Percentage of population subscribed and having telephone service activated within the last 9 months	ITU

[30] The list of countries is contained in annex Table A.2

Table continued

Variable	Variable description	Description	Source
SAT_{ct}^{s} ; $s = 2$	**Penetration fixed**	Percentage of population subscribed	ITU
$LIBER_{ct}^{s}$; $s = 1, 2$	**Unilateral openness (liberalization)**	Number of operators per segment	ITU
REG_{ct}	**Unilateral regulation**	Independence score of the regulatory authority multiplied by the numbers of years in existence	ITU
$GATSLIBER_{ct}$	**Multilateral openness (liberalization)**	GATS commitments score	WTO
$GATSREG_{ct}$	**Multilateral regulation**	Reference Paper score	WTO
$MMARKET_{ct}$	**Multimarket effect**	the total number of time that the firms in a given country are in competition in others African countries	Collected by author
GDP_{ct}	**Income**	GDP per capita	WDI
$DSTE_{ct}$	**Population density**	Percentage of population per square kilometer	WDI
POP_{ct}	**Population size**	Total number of inhabitants	WDI
$GOUV_{ct}$	**Governance**	Kaufmann governance indicators: regulatory quality, policy stability, corruption control	WB
$RENT_{ct}$	**Rent**	Lending prices index	WDI
$ENERG_{ct}$	**Energy**	Energy prices index	WDI
$WAGE_{ct}$	**Wage**	Wage index	ILO

Source Author's construction

5.1.1 Dependent variable: PX_{ct}^{s}

The data for the dependent variables, the price (PX_{ct}^{s}), come from the International Telecommunications Union (ITU). The prices for mobile and local fixed telephony are measured by the official price of a three minutes phone call. However, this price does not account for discounts that are generally available in countries enjoying some level of competition.[31] Hence, it is possible that this indicator suffers from a measurement error that is non-homogenous between countries. This may lead to the attenuation bias (i.e. underestimation of liberalization effects on price).

5.1.2 Variables affecting market power: F_{kct}^{s}

Liberalization measure:

[31] Boylaud and Nicoletti (2001) estimate that discount prices in OECD countries are on average 25 per cent lower than regular rates.

For the liberalization indicator, we adopt an approach that examines both the domestic policies actually applied in the telecommunications sector as well as the level of commitments as specified in WTO Members' GATS schedules.

To measure the level of actual (unilateral) domestic liberalization, $LIBER_{ct}^{s}$, we rely on ITU survey data (ITU, 2005a like Mattoo et al. (2006), Li and Xu (2004), Fink et al. (2001)) and Wallsten (2001). However, we go further than these studies in a number of respects. Notably, we measure the degree of competition for each telecommunications segment separately instead of employing only a "hybrid competition score". The latter approach makes it difficult to disentangle the direct effect that competition within each segment has on segment performance. Wallsten (2001), for instance, simply approximates the degree of competition in the fixed-line segment by the number of mobile operators not owned by the incumbent. Li and Xu (2004) employ one dummy variable to describe the competitive situation in the fixed and mobile telephony segments together. Thus, The degree of competition is characterized by the existing market structure in each segment, with a score of "1" indicating a monopoly, "2" a duopoly and "3" three and more operators.

Unlike most other studies, we also include multilateral liberalization commitments, $GATSLIBER_{ct}$, which may lead to additional effects, not accounted for by unilateral measures.[32] In particular in the African context, where political instability and insecurity are major drags on the level of investment, the quasi-irreversible character of external commitments in the GATS framework is expected to enhance the credibility of reforms, namely that the regulatory framework will be consistent, fair and predictable, thus lowering investment risks (Marchetti, 2004).[33] GATS commitments are used as an indicator of a country's openness to foreign competition. It is measured by a dummy variable that takes the value of "1" for a country with at least one commitment under the GATS and "0" otherwise. This variable is quite weak as a liberalization indicator, since it does not contain

[32] Given the strong partial correlation we find between the unilateral and multilateral indicators of openness and regulation, we have also explored how each performs separately in the regression. This robustness check leaves our results unaffected.

[33] Marchetti (2004) notes that not every commitment may have the same effect on enhancing investor confidence. Specific requests by mode and sector in the current negotiations may give an indication of the kind of regulatory assurances investors are looking for.

any information on the type or level of commitments. Moreover, as was said before commitments in the WTO may be far less liberal than actual practice[34].

Effectiveness of regulation

Three regulatory indicators are considered:

REG_{ct}, the sectoral regulatory quality is approximated by a combination of two components: The principal element is the degree of independence of the regulatory authority from the government according to a range of criteria, such as legal autonomy (i.e. whether or not it is affiliated with the administration), budgetary dependence and process for appointment of members. "1" is attributed to countries where the regulatory authority is independent, while "0" where it is not. The independence indicator is then interacted with the number of years for which the regulatory authority has been in existence[35]. This term allows for the fact that the degree of autonomy and its competence (proxied by its years of experience) may depend on one another. However, if the condition of "autonomy" is presented by UIT (2004) as necessary for an efficient regulation, it could not be a sufficient condition in particular context of African countries, as discussed in Plane (2001): Because of its proximity with the operators, it is not excluded that the regulator uses its discretion for purposes of personal interest in a corrupted environment, creating therefore the possibility for collusions[36].

$GOUV_{ct}$, the governance indicators represented the quality of economy regulation and the political stability is from Kaufman et al. (2005).

$GATSREG_{ct}$, the third regulatory quality indicator is the adherence to the Reference Paper. A dummy is constructed taking the value of "0" for countries that have not subscribed to any regulatory disciplines in the telecommunications sector (beyond general GATS rules), "1" for countries which have committed themselves in regard to certain regulatory disciplines, but not

[34] This variable has been multiplied by the number of years since the submission of commitment at WTO by the country. This allows the utilization of fixed effect technique.

[35] Alternatively, we use the size of the regulatory authority in terms of staff numbers (proxy for its overall resource endowments) to measure its competence. But this variable turn out to be non significant in all our regressions.

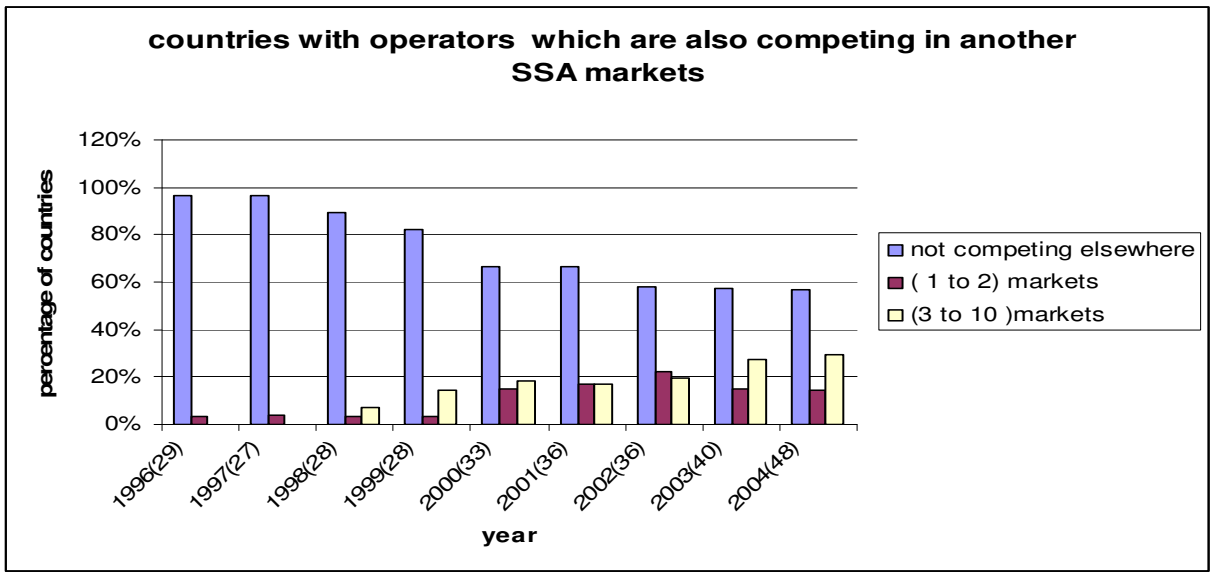
[36] The effective "autonomy" of regulator will be guaranteed if regulatory mechanism impose the plurality of control (see Laffont and Martimort, 1997), or a multi-sectoral and/or multi-regional regulation (Eustache and Martimort, 1999). But these points are not accessed in this study.

the Reference Paper, and "2" for countries having adopted the Reference Paper in total or in part[37].

Multimarket contact $MMARKET_{ct}$

Multimarket contact is perceived to be one of those factors, which can facilitate and sustain implicit collusion among firms engaged in non cooperative rivalry according to "mutual forbearance" assumption (See Bernheim and Whinston, 1990). This is notably possible through the mechanism of "strategic effects" which allow the firms to distribute their market power "through pooling the incentive constraints" across the markets: they can reduce prices and renounce a part of profits in the more collusive markets in order to facilitate collusion, raise prices and augment profits in the more competitive markets, as long as their total profits are maximized (See Bernheim and Whinston, 1990).

Figure 3. Evidence of firms multi-contacts in South Sahara African Mobile market



Sources: author estimation from data collected from UIT and nationals sources via internet.

The multimarket contact, $MMARKET_{ct}$ (alternatively, multimarket competition, multipoint rivalry) is measured by the total number of time that the firms in a given country are in competition in others African countries. The data were collected specially for this study through the internet sources.

[37] As this indicator show not effect probably because of little number of African countries (only 5) that have adopted this reference document, we have excluded its from our regressions.

The IUT provides the e-mails list of all telecommunications regulatory authorities or minister in the world. These sources provide us the history of each operator in the market, while giving the name of multinationals contributing to its capital. The figure3 above gives the proportion of countries with operators which are also competing in another South Saharan African Country. It appears clearly that the multimarket contacts are growing quickly in African market. The share of country whose firms have no multimarket contacts decrease from 98% in 1997 to 58% in 2004.

Market saturation

SAT_{ct}^{s}, the level of market saturation is proxy by the penetration.[38] The Market saturation variable is expected to have a negative correlation with market power. More a market is saturated, more the operators would have incentive to adjust their price in order to attract new consumers.

5.1.3 Economy structure and supply side variables (S_{ct}^{s})

The economic structure variables—the population of the country, per capita GDP and density. —were all available from the World Development Indicators (WDI) 2005 data base of the World Bank (World Bank, 2005). On the supply-side, $ENERG_{ct}$, the index of electricity prices across countries and $RENT_{ct}$, the real interest rate were available from WDI. The average monthly wage of workers ($WAGE_{ct}$) in the country was collected from the ILO. The quantity of telecommunications output, $SUBR_{ct}^{s}$, measured by the number of subscribers in each segments is provided by ITU. The quality of telecommunications services, $QLTE_{ct}^{s}$, have been measured by the share of calls failed. But as this indicator is not available for mobile sector, we considered a different indicator, which is the share of digital subscribers in the country. The two quality indicators were collected from ITU. We have also included the time trend and the country fixed effects.

[38] Nunn and Sarvary measured this variable as the cumulative growth rate of the telephone industry since introduction. The penetration seems to be more relevant as it captures the extent of the market to be conquered by the firms.

5.2 Econometric issues

The first choice estimation technique in the context of simultaneous equations model is the 3SLS (see Green, 2001). Thus, the simultaneity bias is corrected for by using internal instruments. The 3SLS estimation procedure is set out in Zellner and Theil (1962): First, the exogenous variables are taken as instruments for the endogenous variables using ordinary least squares (OLS). Then, each endogenous variable is regressed on both the exogenous variables and the predictions of the endogenous variables. This is the common two stage least squares procedure (2SLS). Finally, the generalized least squares (GLS) estimator is calculated in order to use the additional information of the contemporaneous correlation of the error terms.

The main advantage of using 3SLS compared to the 2SLS is an increase in the efficiency of the estimations. However, if the 3SLS is asymptotically better, they have the disadvantage that any specification error in the structure of the model will be propagated throughout the system while the 2SLS estimator will confine a problem to the particular equation in which it appears. Therefore, we will present results for the two estimators.

5.2.1 Endogeneity problems and choice of instrument

We consider that the indicator of liberalization (number of operator) is endogenous (possibility of simultaneous bias). This relies on the fact that countries with high price or market power could have more incitation to introduce liberalization, in particular for economy under Adjustment structural Plan. As instrument for this indicator, we consider the market size (expressed as the ratio of national GDP on global African GDP). Our empirical estimations in chapter 2 show that this variable is a strong determinant of the number of operator in a given market. However, there is theoretically possibility of correlation between the market size and the price, trough the scale economy effect. This instrument is qualified as "external instrument", since the 3SLS estimates assume all exogenous variables of the model as additional instruments (i.e. internal instruments) [39]. The validity of these instruments is tested using the test of Hansen-Sagan presented, below.

The indicator of GDP has been introduced with the lack with a period to circumvent a potential problem of simultaneity bias between the price and the GDP.

[39] See table. A4 for the identification details

5.2.2 Over-identification problem in simultaneous equation model[40]

The estimation of a simultaneous system requires each equation to be identified. Two conditions have to be verified: the order and the rank conditions.

The order condition require for each equation "s" that the number of exogenous variables included in the system, but excluded from equation (X_s) is greater or equal to the number of endogenous variables in equation (s) minus 1.

$$X_s \geq G_s - 1$$

Our model contains two equations, and each equation has two endogenous variables (dependant variables plus the indicator of liberalization measured by the number of operators). Therefore, the condition of rank is verified in our model, since for each equation included in the system, the number of excluded exogenous variables is always more than one.

But this condition is necessary but not sufficient for identification. The rank condition is sufficient: and imply that the matrix of parameters for the excluded variables in each equation must have rank equal to number of equations in the system minus one. In practice this is always true if the order condition is met with $X_s = G_s - 1$.

But, if $X_s \geq G_s - 1$, as in our case, the model is say to be over identified and a test is necessary to verify the rank condition[41]. The most using test is that of Hansen-Sargan for over-identifying restrictions in regression estimated via the 3SLS in which the number of instruments exceeds the number of regressors (see Baum, Schaffer and Stillman, 2006). This is the test for the joint null hypothesis that the excluded instruments are valid instruments, i.e., they are uncorrelated with the error term and correctly excluded from the estimated equation. A rejection casts doubt on the validity of the instruments in 3SLS. The test computes a p-value comparing the Hansen-Sargan statistic, J, (which is the minimum value) to a criteria build by Davidson & MacKinnon (2004).

The criterion is that of the estimation in « minimum-distance » expressed as follow:

[40] All results presented in this section are proved in Green (2004).
[41] See table. A4 for the identification details

$$\text{criteria} = \text{resid}' \left((\text{nbeq})^{-1} \otimes \text{EXO} * \left(\text{EXO}' \text{EXO} \right)^{-1} \text{EXO} \right) \text{resid} \sim \text{Hansen} / \text{Sarg an stat(J)}$$

Where, *EXO* and resid are the matrix indicating the exogenous variables and the residue

Under the null hypothesis $J \sim chi2(DL)$

With $DL = nbeq * nbEXO - nbcoef(net)$

DL is the Degree of Freedom, *nbeq* is the number of equation, *nbEXO* is the number of exogenous and *nbcoef* (*net*) is the number of parameters net of parameters in constraints.

If the Hansen-Sargan Chi2 p-value >5% the null assumption of the validity of instruments cannot be rejected.

5.2.3 Test of model specification validity

The validity of restrictions (14) and (15) as well as the normalization constraint on MIMIC model is tested using the minimum-distance test statistic described in Gertler (1988). This test allows to circumvent the problem of the subjective choice of the parameter of normalization in the reduce model as points out Breusch (2005). The following discussion is based entirely on Gertler (1988) in which results are proved.

The statistic of the test is:

$$g(\psi) = \left[\hat{\delta} - f(\psi) \right]' \hat{\Omega}^{-1} \left[\hat{\delta} - f(\psi) \right] \sim \chi^2(b) \qquad (16)$$

$\hat{\delta}$ is the matrix of OLS estimate of the reduced form equation in (12)

$f(\psi)$ is a function expressing the coefficients of reduced form equation (12), using the vector of parameters ψ (λ^s, β_k, α_k) estimated through the restrictions of MIMIC model.

b is the difference between the number of parameters in the unrestricted reduced-form equations in (12) (i.e. number of $\hat{\delta}$) and the number of parameters in the restricted equations (9) and (10) (i.e. number of β_k plus α_k). Therefore, the (joint) null hypothesis of this test is that the normalization and proportionality restrictions (i.e. equations 14 & 15) imposed by the MIMIC model are valid.

Ω is the covariance matrix of residue of price in equation (11). It can be formulated as follow:

$$\Omega = E\left[\left(\lambda^s v_{ct} + \varepsilon^s\right)'\left(\lambda^s v_{ct} + \varepsilon^s\right)\right] \quad (17)$$

Following Mccluskey et al (2004), $\Omega = \lambda\lambda' + \sum$

where λ is a vector of market power coefficients and $\sum$ is a diagonal matrix of variances, i.e. diag (σ_1^2, σ_2^2) with $s = 2$ indicating the number of equations (segments) of the system.

5.3 Results

5.3.1 Descriptive statistics (see Table A.1: in annex)

Simple correlation analysis, presented in Table A.1, reveals that, among the variables expected to influence market power, only the effectiveness of regulation (quality of regulation in the country and the quality of regulatory authority) and the mobile saturation are significantly correlates with prices in both mobile and fixed segments. Clearly, this analysis provides limited insight. Table A.1 also shows that GDP per capita is correlated with other economic and demographic variables. Interestingly, although most of variables included in our model are correlated, none of these correlations is very high. Only one correlation between (institution and fixed line saturation) exceeds 0.5. Multicollinearity, therefore, does not seem to be a serious problem.

5.3.2 Econometric results

Before interpreting the results, it is relevant to test the validity of the hypothesis concerning the MIMIC model. The test relies on the statistic of Gertler in equation (16). The joint hypothesis that the normalization and proportionality restrictions are valid cannot be rejected at the 5% significance level. The value of the test statistic is 40, which is distributed as chi-squared with 8 of freedom. Table.4 presents the estimates of the structural MIMIC model. The column (4) and (5) in on hand and the columns (6) and (7) on other represent the estimates of the MIMIC (system) model using respectively the 2SLS and the 3SLS. For each methodology, the first column represents the parameters of the equation related to mobile

segment and the second represent those of fixed segment. As expected, the 2SLS estimates are less efficient than those of the 3SLS. Therefore, the interpretations below are based exclusively on the 3SLS method.

To test the validity of internal exogenous plus the market size as valid instruments of our model, we perform the Hansen-Sargan identification test. The statistic and test are presented in the last line of table 4. The test can not reject the null hypothesis that the instruments are valid (p-value =84%). The 3SLS estimates are then validated.

We analyze our estimates results following successively the parameters of cost determinants, (α_k^s), Parameter of market (λ^s), and parameters of market power determinants (β_k). To be interpreted, the parameters, β_k, of market power determinants would necessitate the coefficient λ^s to be significant**.**

Parameters of Cost determinants (α_k^s)

We are first interested in the **various demand elasticities**, indicated by the coefficients related to the telecommunications output (as measured by the log of the number of subscribers in each segment). As expected, the direct demand elasticities in both mobile and fixed segments are negative with the values of (-0.19) and (-0.25), respectively. However, if the result is strongly significant (at 1%) in the case of mobile telephone, it turns out to be no significant in fixed line segment. The absence of significance in fixed line may reflect the relatively important consumer switching costs across fixed operator services providers, due to longtime monopoly reign on this market[42]. It's more likely that the markup in fixed segment would result in the decrease in minutes of calls, rather than changing the operator.

The **cross elasticity** between the mobile and the fixed segments is positive, suggesting a potential complementary effect between the two segments. However, the result is not significant.

[42] Nunn et al (2004) evidence, in the case of mobile telephone, that the number of years that the first market entrant enjoyed a monopoly prior to competition contributes significantly to reduce the sensitivity of consumer to price decrease, because of the existence of switching costs.

As far as **the services quality indicator** is concerned, the results point to a positive (0.72) and significant (5%) coefficient for the mobile segment, while showing no significant coefficient for the fixed segment. In the case of mobile where the quality is measured by the share of digital (opposite to analogy), the result traduce the fact the operators amputate to the consumer their investments efforts in modernizing telecommunications infrastructure. For the fixed, the absence of significant correlation between the price and the share of calls failed is consistent with the monopoly market structure that characterized this segment in most countries until the starting of years 2000.

Concerning the economic structures variables, the GDP coefficient is positive as expected but not significant. This result suggests that the telephone price through the continent is independent to the level of the country's wealth. The variable of population dispersion as measured by the population density has the expected negative sign, which suggests that price decreases with the density. This relationship is however only significant in the case of the fixed telephone, interpreting the higher potential of network effect in this segment compared to the mobile.

Concerning the variables of production inputs, the energy price index and the wage index have positive and significant coefficients, for both mobile and fixed segments. This result is different from that of Nunn and Sarvary (2004), which find no significant effect of wage and a negative effect of energy price.

Finally, the real interest rate has not significant effect, which is not consistent with the literature. Both Nunn and Sarvary (2004) and Parker & Roller (1997) evidence a strong positive effect of lending rate on mobile price. They justified their results by the fact that the credit financing is a common practice in the cellular industry. However, the absence of correlation in our case could be due to the fact that most of telecommunications operator in Africa are constituted of foreign capital and therefore are less sensitive to local interest rate.

Parameter of market power (λ^s)

This parameter is the test on the existence of market power practice in a given segment (s).
The result accords with the a priori expectation. The estimated market power parameter is 1.09 for mobile telecommunications and is significant at the 5% level. The positive

relationship between industry market power and the price of mobile telecommunication implies that a higher market power leads to the increase of the prices in mobile and fixed telecommunications, which is consistent with economic theory.

Our estimation results also provide information regarding the relationship between the two segments in terms of exercising market power. The positive sign of the estimated market power parameter for mobile segment suggests that an increase in market power in the telecommunication market would cause the price of mobile to increase relative to the fixed telephony.

This finding suggests an ordering of telecommunications segments in the potentiality to exercise market power, i.e., the mobile segment has a greater potentiality than the fixed segment. The existence of market power therefore makes it interesting to explore its origins among the more recurrent factors in the literature: regulatory policy, market saturation, the number of competitor, the international commitments and the multi-contact effect.

Parameters of market power determinants (β_k).

The saturation (market penetration)

The degree of market saturation, as measure by the penetration, contributes to the decreasing of telecommunications market power. The saturation parameter is negative (-0.07) and significant at 5% level. This result is consistent with the empirical finding of Nunn et al (2004). It also supports the theoretical hypothesis (Tirole, 1988) that, as the market grows to the saturation, the firms are obliged to compete on price in order to gain new market share from the competition. This suggests that the particularly high market power in telecommunications observed in Africa is partly related to the low level of penetration.

Regulation

The indicator of the quality of telecommunications regulation interacting with the independence and experience features a negative (-0,71) and significant (at level of 5%) correlation with the market power. This result is consistent with our expectation and the literature, while advocating for the strengthening of regulation efforts that have been undertaken in the continent this last years.

As the sector regulation, the whole economy regulation quality turns out to be not significantly linked to market power although its coefficient of correlation is negative as expected. This result is in opposition of a It should be noted that this indicator does not vary a lot in the time, then most of its effect could be already captured in fixed effects correction.

Unilateral Liberalization: Market structure

The parameter estimate for the number of competitors in both mobile and fixed segments is negative (-0.13). However, it is poorly significant at 10%. This finding is consistent with the theory, as the increasing number of competitors reduces the firms' market power. It's however in opposite of studies by Parker and Roller (1997) on US cellular markets, and by Nunn et al (2004) on a sample of CDEO countries[43].

Multilateral liberalization

As expected, the multilateral liberalization contribute to attenuate the market power in telecommunications industry, as its coefficient turn out to be negative (-0,20) and significant. Its seems that the quasi-irreversibility of the GATS commitments lower the investment risks and then enhance operators to build a longer term strategy of rentability instead of a short term rental extraction. However, the pertinence of the GATS indicator considered here is to be questioned since it does not capture the differences between countries in terms of breadth (e.g. sub-sectors and modes of supply covered by the commitments) and quality of commitments.

Multimarket contact

Finally, the last important result is that, as expected, we find an empirical support for multimarket effect. The result in table shows a positive (0.06) and significant (at 10%) effect of multimarket parameter. This result brings a support to the model of Barnheim and Whinston (1990) and confirms the finding of Parker et al (1997), based on mobile telephone market in US. The similar results has also been evidenced on airlines industries by Evans and Kessides (1994) who show that tariff are higher on a routes where competing carriers have interoute contacts.

[43] Parker and Roller (1997) study justified their result by the fact that the FCC restricted the number of operators in American market to two, a situation which facilitated the collusion behaviors. Nunn et al (2004) justified their own result by a potential multicollinearity problem. Our study doesn't suffer from any of those problems.

Table 4. 3SLS with fixed effect

Variables categories'	Variables	**2SLS**		**3SLS**	
(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
		Eq1 (S=Mobile)	**Eq2 (S=Fixed)**	**Eq1 (S=Mobile)**	**Eq2 (S=Fixed)**
Parameters of Cost determinants(α_k^s)	Constant	-21,76 (-0,20)	0	-18,00 (-0,29)	0
	Density	-0,18 (-1,17)	-0,35 (-1,77)*	-0,16 (-2,13)**	-0,31 (-2,25)**
	Wage	1,14 (2,85)***	0,67 (1,75)*	1,17 (3,41)***	0,68 (1,73)*
	Lag of GDP	1,65 (0,91)	1,77 (1,01)	1,55 (1,02)	2,29 (1,28)
	Population	3,65 (0,73)	2,22 (0,46)	3,28 (0,78)	3,03 (0,62)
	rent	-0,32 (-0,37)	0,11 (0,13)	-0,46 (-0,63)	-0,04 (-0,04)
	energy	1,07 (1,05)	0,57 (1,58)	1,20 (1,59)	0,81 (1,80)*
	Mobile output quantity	-0,18 (-1,79)*	0,10 (0,81)	-0,19 (-2,45)**	0,08 (0,97)
	Fixed output quantity	0,10 (0,81)	-0,22 (-0,55)	0,08 (0,97)	-0,25 (-0,95)
	Mobile quality (share digital)	0,72 (1,71)*		0,78 (2,15)**	
	Fixed quality (share calls failed)		-0,05 (-1,12)		-0,05 (-1,41)
	Trend	0,05 (1,39)	0,03 (0,88)	0,04 (1,48)	0,03 (0,81)
Parameter of market power (λ^s)	**Market power**	**1,06 (2,39)****	**1**	**1,09 (3,06)*****	**1**
Parameters of market power determinants (β_k)	Constant	-58,05 (-0,89)	-58,05 (-0,89)	-45,39 (-0,71)	-45,39 (-0,71)
	Multilateral liberalization (GATS commitment)	-0,20 (-1,99)*	-0,20 (-1,99)**	-0,15 (-1,84)*	-0,15 (-1,84)*
	Unilateral liberalization in fixed (number of fixed operator)		**-0,13 (-1,36)**		**-0,15 (-1,67)***
	Unilateral liberalization in mobile (number of mobile operator)	**-0,13 (-1,36)**		**-0,15 (-1,67)***	
	Multimarket effect	0,06 (1,66)*	0,06 (1,66)*	0,06 (1,69)*	0,06 (1,69)*
	Unilateral regulation	-0,29 (-1,42)	-0,29 (-1,22)	-0,71 (-1,73)*	-0,71 (-1,73)*
	Governance	9,70 (0,60)	9,70 (0,60)	-2,81 (-0,19)	-2,81 (-0,19)
	Saturation: Mobile penetration	-0,07 (-1,81)*		-0,07 (-2,11)**	
	Saturation: Fixed penetration		-0,07 (-1,81)*		-0,07 (-2,11)**
Statistics and tests	Countries	**30**	**30**	**30**	**30**
	OBS: 30 X 4	99	99	99	99
	Hansen-Sargan test	J=34.351 H0: Chi-sq(22), pval = 0.35		J=14.612 H0: Chi-sq(22), pval = 0.64	
	Durbin-Watson stat	1.926	1.957	1.926	1.957
	R^2	**0.35**	**0.17**	**0.35**	**0.16**

Absolute value of z statistics in parentheses : significant at 10%; ** significant at 5%; *** significant at 1%*

Notes: (1) the eq1 and eq2 are the two equations constituting our model. They have been simulated simultaneously; (2) by assumptions, the parameters of market power determinants are the same in mobile and fixed segment; (3) Among, parameters of marginal cost, we have assume the intercept of fixed segment to be zero($\alpha_0^{s=2} = 0$ *). We have also normalized the coefficient of market power related in fixed segment equation to one (* $\lambda^{s=2} = 1$ *).*

Structure of market power in Africa

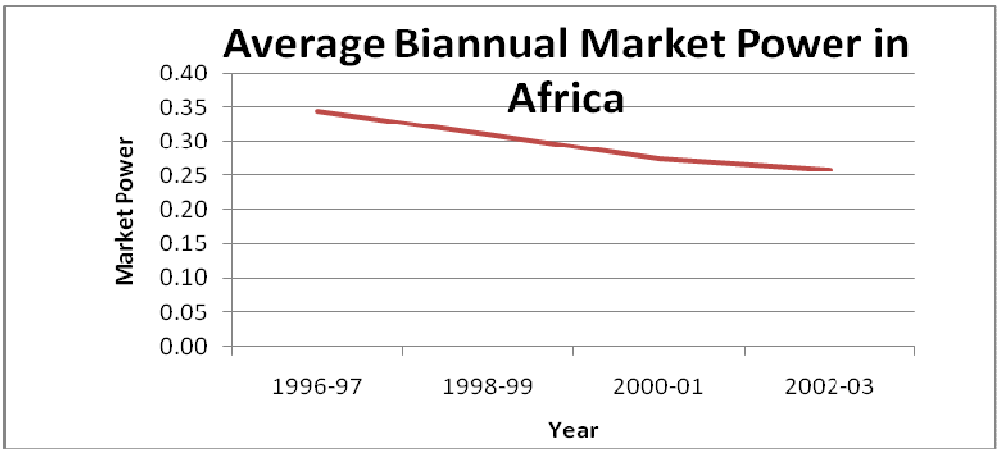
After showing the evidence of the existence of market power and its determinants, we rely on the above estimates to compute (predict) its amplitude. The market power is derived from equations (4) and (10) following the formulation below:

$$\hat{\phi}_{ct} = 1 - EXP\left[\hat{\beta}_0 + \sum_{k=1}^{K} \hat{\beta}_k \log\left(F_{kct}\right)\right] \qquad (18)$$

Our calculations reveal average amplitude of market power (between 1996 and 2003) of 0.29. The minimum is 0.14 and the maximum is 0.37 (standard deviation of 0.05). This implies that the telecommunication price in Africa is majored on average by 29% because of the existence of market power practices.

It's particularly instructive to follow the evolution of the market power through the time. The figure4 below, show the prediction of the biannual average of market power in Africa between 1996 and 2003.

Figure 4. Evolution of market power from 1996 to 2003 in Africa



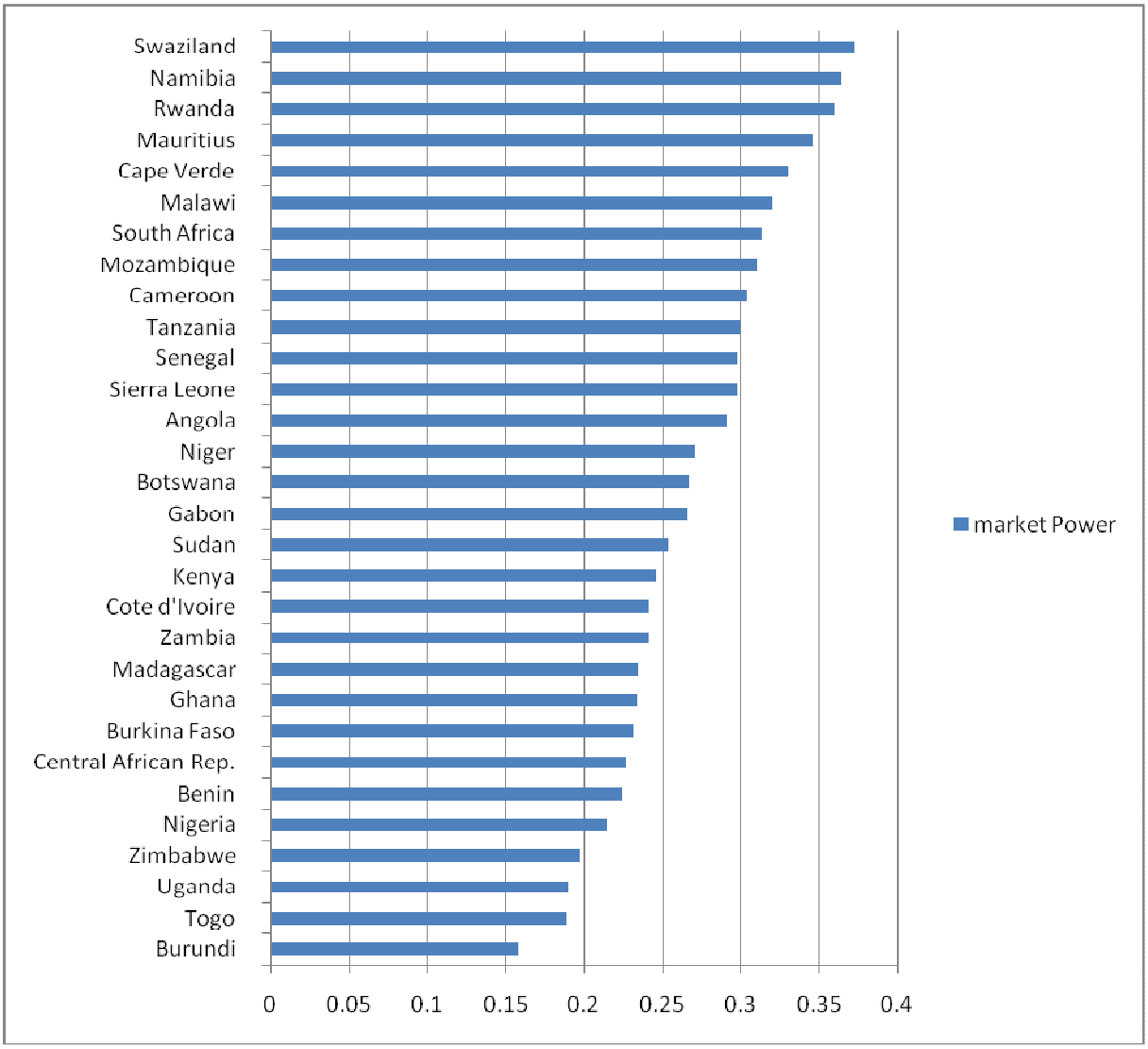
Source: Author's construction

The market power is following a slowing trend, moving from 0.37 in 1996 to 0.28 in 2003. This is the manifestation of the efficiency (even limited) of the reforms undertaken during that

period and which turn out to have significant effect in our estimates (increasing in number of operators, multilateral liberalization). It's also due to the pressure imposing by the increasing saturation of market which constraints operators to reduce their price if they want to gain new market share.

As the telecommunications policies are undertaken at national level, analyzing market power for individual countries could be of particular interest. The figur5 below reveals the prediction of market power for the 30 African countries of our sample in 2003.

Figure 5. Prediction of Market power in African countries for the period of 2002-03



Source: Author construction

The country with the least important market power is the Burundi (0.16), while the one with the more important is the Swaziland (0.37). The average African position is occupied by Angola with 0.29. The table A4 in annex ranks countries in the figure 5 according to the

market power amplitude while displaying the relevant level of competition prevailing in each segment of telecommunications. Globally, the countries on the top of the list of market power practice seem to be those maintaining monopole in all telecommunications segments. Conversely, the countries where the competition has been introduced partially or fully have least important market power practice[44].

[44]This observation is a confirmation of the significant correlation perceived in our estimates and does not exclude others markup determinants reveal by our model.

6 Conclusions

In this study, we use The MIMIC model to estimate the market power and its sources in telecommunication industry. The empirical estimate is based on aggregate price and quantity biannual data from 30 African countries between 1996 and 2003. We consider two "indicators variables" (or dependent variables) in our MIMIC model: the prices in mobile and fixed telephony segments. As "causes variables", three set variables are used: (1) the variables of liberalization, including unilateral liberalization (number of operators allowed in each segment), and multilateral liberalization (subscriptions of commitments in the framework of GATS); (2) the variables of regulations at sectoral level (autonomy and experience of regulatory authority) and at national level (Kaufmann governance indicators: regulatory quality, policy stability, corruption control); (3) the organizational structure variable captured by the multimarket contact (reflecting the situation of two operators whose parent companies would be competing in more than one market).

Three main results emerge from our estimates: First, the African telecommunication industry faces a strong and significant market power, which maintains the continent prices above the competition level. Second, beyond the increasing in penetration which contributes to attenuate the market power, three policy factors seem also to be affecting it negatively: the unilateral (domestic) efforts in term of liberalization (increasing in number of operators) as well as strengthening sectoral regulation, and the multilateral subscriptions of commitments to liberalize in the framework of the GATS at WTO. Third, it appears, as evidenced by Parker and Roller (1997), that multimarket contact of telecommunications operators is an important factor explaining the cooperative pricing behavior.

While our findings may suffer from many limitations (see below), a number of policy implications can be drawn with respect to the telecommunications trade at domestic, regional and multilateral levels. At local level, it's relevant to allow more licenses,

particularly in fixed segment where monopole still exists in numbers of African countries. The strengthening of regulation authority autonomy and competencies should remain a priority. Moreover, it seems that a regulation with a regional perspective would be more fruitful. Our finding that the multimarket contact enhances market power clearly advocates for current projects to establish sub-regional or regional regulatory institutions in Africa. Finally, in the current context of multilateral trade negotiations on services, our findings provide evidence that the commitments subscribed in the framework of GATS could be a complementary factor in enhancing competitiveness in telecommunications market in Africa.

Our analysis has some important limitations. First, and most importantly, in our data set, price and quantity data are only available at an aggregate level for each country. Furthermore, the aggregate nature of the data and the resulting empirical model do not allow for differences across firm behaviors.

Second, as all international studies, ours also suffers from the lack of available variables across a large number of countries. Thus, for our main variable of interest, market power, we may have an omitted variable problem. For example, the literature evidences that cross-ownership across cellular operators (See. Parker and Roller, 1997), and the number of years that the first market entrant enjoyed a monopoly prior to competitive, are important predictor of market power. But we did not have data to test this hypothesis in our international context.

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Annexes

Table A.1: Partial correlation of main variables in market power model

	Mobile price	**Fixed Price**	**GDP/ capita**	Institu-tion	Mobile saturation	Interest rate	Electric cost	Rent Indices	Mobile penetration	Fixed penetration	GATS Commit ment	DOC REF	Operators collusion	Nbre mobile operators	Nber fixed operators	Nber inter optors	density	urban Popult	Regulator quality	POP	Nber Mobile lines
	1	**2**	**3**	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Mobile price	**1**																				
Fixed price	**0.6577***	**1**																			
GDP	**0.5954***	**0.7154***	**1**																		
Institution	**0.0059**	**-0.1523***	**0.0523**	1																	
Mobile saturation	**-0.2807***	**-0.1062***	**0.1177***	0.3352*	1																
Interest rate	**0.1275**	**0.0177**	**-0.0298**	-0.2279*	-0.1987*	1															
Electric cost	**-0.1122***	**-0.0283**	**-0.1566***	-0.057	0.0011	0.0802	1														
Rent indices	**-0.2536***	**0.0351**	**-0.0721**	-0.0012	0.1875*	0.0339	0.3279*	1													
Fixed saturation	**-0.1360***	**-0.0042**	**0.3507***	0.5788*	0.5867*	-0.1714*	-0.045	0.0624	0.5867*	1											
GATS commitment	**0.0892**	**0.0523**	**0.0266**	0.017	0.0415	-0.094	0.2236*	0.1415*	0.0415	0.0417	1										
DOC REF	**0.0203**	**-0.1161***	**-0.0584**	0.1945*	0.1580*	-0.0696	0.1742*	0.0535	0.1580*	0.1914*	0.5413*	1									
Operators collusion	**0.0533**	**-0.0541**	**-0.1548***	-0.0883*	0.1211*	0.0626	-0.0494	0.0351	0.1211*	-0.1700*	-0.1581*	-0.0716	1								
Nber mobile operators	**0.017**	**0.0341**	**-0.1121***	0.0117	0.2423*	0.0233	0.0221	0.0519	0.2423*	-0.1291*	-0.0309	0.0741	0.1792*	1							
Nbr fixed oprtors	**-0.2569***	**-0.0758**	**-0.2174***	-0.2552*	0.1722*	0.0449	0.2299*	0.0442	0.1722*	-0.1658*	0.1454*	0.0418	0.0292	0.2378*	1						
Nber inter operators	**-0.1910***	**-0.0556**	**-0.2100***	-0.1910*	0.2117*	0.1042	0.2975*	0.1213*	0.2117*	-0.1759*	0.1007*	0.0432	0.082	0.3571*	0.7616*	1					
density	**0.0187**	**0.1371***	**0.0253**	0.0631	0.0756	0.0471	0.0674	0.1514*	0.0756	0.1915*	-0.0141	0.0927*	0.0294	-0.0382	0.0067	0.0456	1				
urban Popult	**0.1107***	**0.1584***	**0.3713***	0.0019	0.3187*	0.045	0.0627	-0.0672	0.3187*	0.3896*	0.3410*	0.2355*	-0.1371*	0.0549	0.0395	0.0053	-0.3101*	1			
Regulator quality	**-0.1814***	**-0.2060***	**-0.2631***	0.05	0.1542*	-0.0568	0.2049*	0.0279	0.1542*	-0.0036	0.0635	0.0651	0.1647*	0.0498	0.1923*	0.0988*	-0.051	-0.0107	1		
POP	**-0.1750***	**-0.3763***	**-0.5869***	-0.2070*	-0.2822*	0.0765	0.2383*	-0.0992*	-0.2822*	-0.4660*	0.2053*	0.2694*	0.1411*	-0.0129	0.2593*	0.2009*	-0.1018*	-0.2686*	0.4169*	1	
Nbr Mobile lines	**-0.3966***	**-0.3102***	**-0.2419***	0.1435*	0.7673*	-0.1436*	0.1403*	0.1074*	0.7673*	0.1800*	0.2334*	0.3353*	0.1928*	0.2641*	0.3628*	0.3559*	0.0318	0.1569*	0.4327*	0.3495*	1

Table A.2. List of countries included in our econometric sample

Number	Countries
1	Angola
2	Benin
3	Botswana
4	Burkina Faso
5	Burundi
6	Cameroon
7	Cape Verde
8	Central African Rep.
9	Cote d'Ivoire
10	Gabon
11	Ghana
12	Kenya
13	Madagascar
14	Malawi
15	Mauritius
16	Mozambique
17	Namibia
18	Niger
19	Nigeria
20	Rwanda
21	Senegal
22	Sierra Leone
23	South Africa
24	Sudan
25	Swaziland
26	Tanzania
27	Togo
28	Uganda
29	Zambia
30	Zimbabwe

Source: Author construction

Table A.3. Ranking of African countries in term of telecommunications market power practice and the relevant level of competition in 2003

Rank	Country	MARKUP	Number of mobile Competitors in 2003	Number of fixed Competitors in 2003
1	Swaziland	0.37	M	M
2	Namibia	0.36	M	M
3	Rwanda	0.36	M	M
4	Mauritius	0.35	P	M
5	Cape Verde	0.33	C	M
6	Malawi	0.32	C	M
7	South Africa	0.31	C	M
8	Mozambique	0.31	C	M
9	Cameroon	0.30	C	M
10	Tanzania	0.30	C	M
11	Senegal	0.30	C	M
12	Sierra Leone	0.30	C	M
13	Angola	0.29	P	P
14	Niger	0.27	C	C
15	Botswana	0.27	C	P
16	Gabon	0.27	C	P
17	Sudan	0.25	M	C
18	Kenya	0.25	P	P
19	Cote d'Ivoire	0.24	P	P
20	Zambia	0.24	C	M
21	Madagascar	0.23	C	C
22	Ghana	0.23	P	P
23	Burkina Faso	0.23	P	M
24	Central African Rep.	0.23	C	M
25	Benin	0.22	C	M
26	Nigeria	0.21	P	C
27	Zimbabwe	0.20	C	C
28	Uganda	0.19	P	P
29	Togo	0.19	P	P
30	Burundi	0.16	C	C

Source: authors' calculation
Note: M: Monopoly; P: Partial competition; and C: Full Competition

Table A.4 **Identification of the model**

Category of variables	**Number of variables (category) in each equation**	**variables**
Dependant variable		Price of telecommunications
Endogenous variables:	$G_s = 2$	Price of telecommunications
		Unilateral liberalization (number of operators)
Internal exogenous variables		Density
		Wage
		Lag of GDP
		Population
		rent
		energy
		Trend
		Multilateral liberalization (GATS commitment)
		Multimarket effect
		Governance
		Unilateral regulation
		Quality of services
		Services Output
		Saturation
Excluded exogenous variables	X_s=2	Saturation
		Quality of service
External exogenous variables (instruments)		Market size (ratio of national GDP on global African GDP);
		Lagged of Market size (-1)

Source: Author construction

Notes: (1) G_s *is the number of endogenous variables in equation (s) . (2)* X_s *is the number of exogenous variables included in the system, but excluded from equation (s). (3) The order condition require for each equation "s" that* $X_s \geq G_s - 1$.

CHAPTER III: IMPACT OF THE LIBERALIZATION OF TRADE IN SERVICES ON THE AFRICAN GROWTH: CASE OF TELECOMMUNICATIONS AND FINANCIAL SERVICES

1 INTRODUCTION

In many developing countries, the widespread implementation of trade liberalization policies during the last two decades has not been reflected in sound economic performances. This is particularly the case of African countries, which remain marginalized in the international trade framework.

Recent literature points to the poor quality and the insufficiency of services, as important explanatory factors of Africa's marginalization. In fact, African service trade policies have been for long time characterized by numerous institutional rigidities including, a strong regulation, an omnipresence of the official monopolies, and (before the nineties) a strong discrimination towards Foreign Direct Investments (FDI) in key services sectors such as telecommunications, electricity, transport and finances. These factors lead to high costs, which damage the competitiveness and productivity of entire economy. A study by Eifert, Gelb and Ramachandran (2005), using data from purchasing power parity (PPP) estimates, confirmed that Africa is high-cost relative to its levels of income and productivity, while Collier and Gunning (1999) considered high transaction costs as the most significant impediment to economic growth in Africa.

However, the results of the multiple reforms experimented on the African services sector seem rather mitigated. Only the telecommunication sector seems to have achieved confirmed results, particularly with the boom in the mobile telephony and internet market segments. While up to 1995, there were less than 10 million mobile phone users in Africa, more than 13 million joined African networks in 2003 alone, carrying the total number of users to about 52 million. The International Telecommunications Union (UTI, 2004) estimates that African telecommunications operators in 2003 realized more than $10 billion in revenues and about $1 billion in earnings[45].

In other sectors, completely or partially privatized, the improvement of the performances is not obvious. Mattoo et al. (2006) showed in the case of Zambia that the benefits expected from establishing an open, private, and largely foreign-owned banking system in the early 1990s have

[45] Cf. UIT (2004) Indicateurs des Télécommunications Africaines 2004, P.1.

not so far materialized and that access to banking services is low, unequal and extremely expensive[46].

Noting that the strengthening and the extension of the General trade agreements on trade in services (GATS) constitute an important component of the WTO's current multilateral trade negotiations, while privatizations operations are continuing in developing countries, the aim of this study is to assess the impact of services trade liberalization on economic growth performances.

The extensive literature on the link between the services sector and growth has been for long time silent on the effect of services trade openness on growth. This is at least in part due to the lack of evidence of significant correlation that emerges from studies assessing the direct link between the services trade liberalizations and growth[47]. For example, Djiofack and Keck (2006) found no impact of telecommunication service trade liberalization –as measured by the number of operators and the commitments in the GATS– on growth in Africa for the period from 1997 to 2003. Demirguc-Kunt, Levine, and Min (1998) do not find any direct link between foreign banks and long-run economic growth for the period from1988 to 1995.

Thus, main studies have focused on services sectoral performances and assessed, on the one hand, the link between services trade openness and sectoral performances (telecommunications infrastructure or financial development), and on other hand, the relationship between sectoral performance and growth. Overall, they find a positive and significant contribution of services trade openness to sectoral performances (see Claessens, D. Kunt and Huizinga, 2001 and Boylaud and Nicoletti, 2000), which in turn are growth-enhancing (see Norton, 1992 for the telecommunications role) and financial development (see Levine et al. 1999).

These two categories of relationship suggest the existence of an indirect relationship between services trade openness and growth. This is increasingly assessing in literature, through the simultaneous estimation of both links, between services trade policy and sectoral performances, and between performances and income growth (see Bayraktar and Wang, 2006 and Francois and

[46] Credit to the private sector represented only 8% of GDP in 2005, which is lower than the level registered in 1990, while the average annual interest rate on loans was 48% in 2005.
[47] Another reason is the lack of data (see Karsenty, 2000) due to the fact that the GATS (general Trade Agreements on Services) constitute a new dimension in multilateral trade agreements.

Eschenbach, 2002). Francois et al. (2002) established a causality chain from financial services trade openness to growth, including the following three stages of causation: (1) Services trade liberalization contributes to decrease the concentration of market structure, (2) which will reduce the market power and then contributes to the sectoral performances, (3) which ultimately participate to a higher economic growth. This study relies on this indirect approach to assess the link between the services' trade openness and growth in South Saharan Africa.

The first contribution of this chapter consists in extending this approach, developed in financial sector, to the telecommunication services and to apply it for the first time to a set of African countries. In addition, the usage of panel data allows overcoming the heterogeneity issue that the Francois et al. (2002) study suffers. Finally, we will assume that simultaneous causation exists between services sectoral performances and growth as in Röller and Waverman (2001).

Estimates based on mobile telecommunications and banking services sectors, point to mixed results. In telecommunications sector, the services trade openness, as measured by the country commitments in the framework of GATS, shows no correlation with the level of competition (number of operators). However, competition has a strong effect on telecommunications services accessibility, which in turn influences income growth significantly.

In the case of the financial sector, the services trade openness, as measured by the liberalization of cross-countries operations, appears to be a strong determinant of market competitiveness, as measured by the level of banking concentration. However, the level of competition in the financial market shows not significant link with the sectoral performances either captured by the level of credit to private sector or the interest rate spread. As the last stage in the Francois et al. causality chain, the sectoral performances indicators emerge as strong determinants of income growth. As an important difference with telecommunications sector, the financial performances effect on growth seems to be correlated to the development level, among Africa countries, the most developed countries enjoying higher gain.

Finally, the results evidence like in previous studies a double causation between growth and sectoral performances (see Sridhar and Sridhar, 2004). This holds for the both telecommunications and financial sector.

This chapter is organized as follows: Section II presents a brief literature review of existing studies assessing services trade impacts on income growth. Section III sets out the model estimated. Section IV raises the econometric issues related to the three-stage least squares (3SLS) used in this study. Section V gives the econometric results and discusses their sensitivity. This part considers an alternative specification (GMM dynamic panel) to the 3SLS, and assesses the stability of results in respect to the development level of countries.

2 Literature review of services trade effects and growth performances[48]

2.1 Telecommunications and income growth

The literature mainly analyzed the growth effect of telecommunications, trough the telecommunications infrastructures role, which match to the last stage of the causality chain assessed in this study. One of the pioneering studies in this area is that of Hardy (1980), for a group of developed and developing countries, which indicates that telephones per capita had a significant impact on GDP. More recently, Waverman, Meschi and Fuss (2005) in their study of low and middle-income countries, find that mobile telephony has a positive impact on economic growth.

Norton (1992), in assessing the transmission channel of telecommunications infrastructure effects on income growth, concluded that telecommunications penetration reduces transaction costs and increases income output, by improving capital markets' efficiency and boosting investment.

Instead of looking for infrastructure effects as in Norton (1992), Mattoo et al. (2006) assessed the direct link between the income growth and the liberalization of telecommunications services using a sample of developing countries. They find evidence for significant influence of telecommunications service trade openness on long run growth performance.

However, an increasing part of the literature questioned whether the positive relationship between telecommunications and economic growth is really a result of reverse-causality i.e. that higher telecommunications accessibility is the result of higher growth and not vice versa. Madden and Savage (1998) investigates the issue using causality tests. Both studies find evidence of a two-way causality between telecom penetration and economic growth.

To account for the simultaneity effect between the telecommunications performances and growth, Röller and Waverman (2001) estimated simultaneous model of growth and telecommunications penetration, using the 3SLS estimator. Relying on OECD group of

[48] A more comprehensive survey is provided in annex table A11. Also see Nielson and Taglioni (2004), for a comprehensive literature analyzing the role of services on growth, including a large variety of services.

countries, they found a strong two-way relationship between telecommunications infrastructure and productivity. This finding is confirmed by Sridhar and Sridhar (2004) who replicate the Röller and Waverman (2001) model for developing countries sample (including those of Africa). In this study, we follow this approach by estimating simultaneously a model of growth and penetration.

2.2 Financial sector and income Growth[49]

The importance of the financial sector for economic growth has long been documented, most authors focusing on the role of financial development on income growth, since the seminal work in this area by Goldsmith (1969). Globally financial development or performances is found to be significantly correlated with growth[50]. However, as noticed by Hoekman (2006), the literature on financial development does not sufficiently counter for the role of international trade in financial services and are generally silent on the role of policy.

One of the exceptions is the study by Gelbard and Pereira (1999) using a set of 38 African countries over the 1987-97 period. They used a composite financial development variable including various financial policy aspects to find a positive impact of financial sector on growth[51]. In line with this approach, Mattoo et al. (2006) found econometric evidence that the financial sector openness (based on the commitments of countries in the framework of GATS and capital controls index of Dalaimi (1999)) influences long run growth performance.

However, many studies investigating the direct link between foreign banks and growth could not find any robust results (see Demirguc-Kunt, Levine, and Min, 1998). Thus, many researchers have been studying the indirect links between finance and growth. Francois and Schucknecht (1999) and Francois and Eschenbach (2002) established a causality chain between the two indicators, through a system estimations based on 130 countries. However,

[49] A very comprehensive survey on this literature is provided in Hoekman (2006) and Eschenbach(2004). The main studies in this area differ from each other by the choice of financial development performance indicators. The most recurrent being the credit to private sector (See Degregorio and Guidotti, 1995), interest rate distortion (Roubini and Sala-I-Martin, 1992), the interest rate spread (Johnston and Pazarbasioglu 1995), the financial depth (Goldsmith, 1969; Demetriades and Husein, 1996, King and Levine, 1993 and Levine and Ross, 1997) and the stock market activity (Arestis Demetriades and Luintel, 2001)

[50] The study by Arestis Demetriades and Luintel (2001) belong to the few exceptions, as they found only a weak relationship between the market stock activity and growth.

[51] The policy components of financial development indicators used in Gelbard et al. are, the level of financial liberalization, the institutional change and the financial products varieties

their study in cross-sections suffered from heterogeneity problems. In addition, the authors did not account for simultaneous bias between the sectoral performances and growth.

A recent study by Bayraktar and Wang (2006) targets these issues, reinvestigating the direct and indirect links between foreign bank entry and economic growth through the GMM technique in dynamic panel. Using a two-step model, the first stage results show that a higher share of foreign banks lowers overhead costs and net interest margins of domestic banks, indicating higher efficiency. In the second stage, they show that a higher efficiency increases economic growth. As for telecommunications, we account for simultaneity effect in financial sector regression by introducing the growth as a control variable in financial performances model.

As well for telecommunications as for financial sector, this study follows the indirect approach of growth effect.

3 Empirical Model

This section presents the three-stage causality chain between services trade liberalization and growth.

First stage: Market structure as function of trade openness

The market structure model, linking the level of competition to the service trade openness, constitutes the first stage in the causality chain tested in this study. As in Francois et al, the specification is given in equation (i):

$$\log COMP_{it} = b_1 + \alpha_1 \log LIB_{it} + \lambda_1 \log PERF_{it} + \beta_1 \log E_{it} + \mathrm{w}_i \qquad \text{(xix)}$$

Where the market structure indicator $COMP_{it}$ is assumed to be a log-linear function of services trade liberalization (openness), LIB_{it}, performance indicator, $PERF_{it}$ (which allows to account for the simultaneous relationship between performances and market structure), and a set of exogenous controls variables, E_{it}. w_i denotes the error term; α_1 , λ_1 and β_1 are parameters to be estimated.

3.1 Second stage: Sectoral performances as function of services market structure

3.1.1 Model specification

The literature on telecommunications services performances considered generally a simple linear-form model specification. This holds for studies on developed countries (see Boylaud and Nicoletti, 2000) as well as developing countries (Fink, Mattoo and Rathindran 2003 and Doumboya, 2004). Regarding the specification of financial performances model, a more complex method is usually considered. As most of studies used banks level data, they generally considered a two-step model, including a banks level estimate (to account for the banks specific effects) and a countries level estimate (see Saunders & Schumacher, 1997; and Kalirajan, McGuire, Hong & Schuele (2000)[52].

Since the data used in this study is aggregated at the economy level, the specification considered is a simple log-linear form function as well for telecommunications as for financial services. The service performances model is then specified by the following reduced form where the performance indicator ($PERF_{it}$) is expressed as the log linear function of the level of competition ($COMP_{it}$) in service sector and the matrix of controls variables (D_{it})[53]. The growth indicator, Y_{it}, is also included to account for the simultaneous relationship between the growth and market performances.

$$\log PERF_{it} = b_2 + \alpha_2 \log COMP_{it} + \lambda_2 \log Y_{it} + \beta_2 \log D_{it} + \mathrm{v}_i \qquad \text{(xx)}$$

Where the i and t indices indicate the country and the period respectively. v_{it} is the error term in equation (i). α_2, λ_2 and β_2 are parameters to be estimated in performance equation.

[52] They estimate the two step estimation model of Ho and Saunders (1981). In the first step, they estimate, at banks level, the Net interest margin (NIM), from which they extract the pure spread (sum of constant estimation and the specific country effect). The second step estimates at the economy level the pure spread.

[53] This is the specification adopted by Nicoletie and Boyleau (2000) and Doumboya (2004) for the telecommunications studies

3.1.2 Endogeneity problem

As already pointed out, it is conceivable that the correlation coefficients between sectoral performances and the competition variable suffers from simultaneity bias and rather reflect the impact of performances on competition policies and not vice versa. Nicoletie and Boyleau (2000) point to this endogeneity problem arguing that, on the one hand low performances may make liberalization (introduction of competition) urgent and that, on the other, foreign operators are attracted by situations in which there are margins for productivity gains and the possibility to gain market shares through price reductions. However, as the previous literature, they do not correct for this problem. The simultaneous estimate of the performances with the market structure model, specified in below, will overcome the issue.

3.2 Third stage: Growth model and sectoral performances

Following the specification of the linkages between the services trade liberalization and the performances above, this section completes the causality chain by establishing the relationship between the sectoral performances and income growth.

We consider a standard growth model, into which the performances indicators are introduced. The underlying model of endogenous growth of real GDP per capita follows Barro (1997). Apart from the classic explanatory variables, i.e. production factors (gross fixed capital formation as a proxy for investment, ratio of secondary education as proxy for human capital), the control variables are introduced for human development (life expectancy), macroeconomic policies (inflation), openness (exports as a share of GDP), governance (political stability)[54] and demography (population growth) (World Bank, 2005). We have not conducted any analysis of additional conditioning variables to be included in growth regressions in the African context (for instance via extreme bounds analysis (EBA) (Sala-i-Martin, 1997) or Bayesian averaging of classical estimates (BACE) (Sala-i-Martin et al, 2004), preferring to adopt the selection by Easterly and Levine (1997).[55] Hence, we also include dummies for war (Banks, 2005) and colonial powers (Barro, 1999).[56]

[54] As a measure of "good governance", apart from policy stability, we have included alternatively other Kaufmann indicators, namely regulatory quality and corruption control. See Kaufmann et al. (2005).
[55] Easterly and Levine (1997) use a larger set of variables, but are in accordance with Sachs and Warner (1997), who rather emphasize the importance of trade openness and economic policies. We also use individual dummies for European colonial powers, following Masanjala and Papageorgiou (2006).
[56] These variables all turn out to be insignificant and therefore are not further discussed.

Beside these standards variables of growth literature, we finally introduce a measure of services performances. The model is specified as follow:

$$\log Y_{it} = b_3 + \alpha_3 \log PERF_{it} + \beta_3 \log C_{it} + \lambda_3 \log Y_{i(t-1)} + u_i \qquad \text{(xxi)}$$

Where Y_{it} denotes the average real GDP per capita and C_{it} is a vector of the growth controls variables. α_3 and β_3 are parameters to be estimated in growth equation.

$Y_{i(t-1)}$ denotes the lag of GDP per capita

As discussed above, the performance indicator, $PERF_{it}$ and the GDP influence each other, as we expressed the performance as a function of the revenue. Norton (1992) and Datta et al. (2004) raised the issue of the potential bias generated by this simultaneity effects, but do not bring any correction[57]. We follow Röller and Waverman (2001) by overcoming this through simultaneous estimation of growth and sectoral performances equations. The model to be estimated is then a system of three simultaneous equations containing real GDP per capita, the structure of market and performances indicators as left-hand side variables respectively.

$$\begin{cases} \log COMP_{it} = b_1 + \alpha_1 \log LIB_{it} + \lambda_1 \log PERF_{it} + \beta_1 \log E_{it} + w_i & (i) \\ \log PERF_{it} = b_2 + \alpha_2 \log COMP_{it} + \lambda_2 \log Y_{it} + \beta_2 \log D_{it} + v_i & (ii) \\ \log Y_{it} = b_3 + \alpha_3 \log PERF_{it} + \beta_3 \log C_{it} + \lambda_3 \log Y_{i(t-1)} + u_i & (iii) \end{cases}$$

The system would be estimated separately for each of the two sectors, telecommunications and finances, considered in this study.

4 Descriptions and sources of data

4.1 Data description

The table1 here below lists the indicators introduced in each equation for both the telecommunications and financial services.

[57]In fact their treatments of endogeneity problem only consist to include the lagged value (Datta and Agarwal, 2004) or the initial period value (Norton, 1992) of telecommunication performances to prove the existence of an effect of telecommunications on growth. But, they do not attempt to isolate the two effects.

[57] For example, concerning the model of telecommunication performances, the more obvious omitted variable is the quality of services, since the better services quality will encourage subscriptions.

Table 1. Model specification: Presentation of indicators

		telecommunications		**Finances**	
		Indicator	**expected sign**	**Indicator**	**expected sign**
Eq (i)	dependent variable : $COMP_{it}$	**Number operator**		**Competition**	
	Liberalization: LIB_{it}	**Telecom services openness**	+	**Financial openness**	+
	Performances: $PERF_{it}$	**Penetration**	-	Spread /Credit to private	+/-
	Controls: E_{it}	Telecom regulation	+	Market size	+
		Market size	+	population	+
		Population	+	Time	+
Eq (ii)	dependent variable : $PERF_{it}$	**Penetration**		**Spread/Credit private sector**	
	Growth: Y_{it}	**GDP/capita**	+	GDP/capita	-/+
	Market structure: $COMP_{it}$	**Number operator**	+	**Competition**	-/+
	Controls: D_{it}	Lag fixed price	+	Interest instability	+/-
		Lag mobile price	_	Time	-/+
		Density	+		
		Time	+		
Eq (iii)	dependent variable : Y_{it}	**GDP/capita**		**GDP/capita**	
	Performances: $PERF_{it}$	**Penetration**	+	**Spread/Credit private sector**	-/+
		Lag of **GDP/capita**	+	Lag of **GDP/capita**	
		PoP growth	+	PoP growth	+
		Trade openness	+	Trade openness	+
		Life expectancy	+	Life expectancy	+
		Inflation	-	Inflation	-
		Institutions	+	Institutions	+
		Tertiary education	+	Tertiary education	+
		Investment	+		
		Time	+	Time	+

Source: Author construction

4.1.1 Telecommunication model variables

Telecommunications services performances ($PERF_{it}$) can be defined in terms of quality of services (call failure rate), of industry productivity (ratio of labor input to number of lines), of services prices and services accessibility (see Boylaud and Nicoletti, 2000). Due to the lack of appropriate data, I will consider only the penetration in mobile sector. Doumbouya (2004), one of the rare quantitative empirical studies that exclusively focus on African countries, also considered this indicator[58].

[58] Shirley (2001) adopts a descriptive approach presenting case studies of telecommunications reform in six African countries and various performance statistics.

The market structure ($COMP_{it}$) in telecommunications is measured by the number of operator in mobile segment. By introducing competition, the improvement of market structure is expected to be positively correlated with services accessibility.

The telecommunications **services trade openness**, LIB_{it} , is measured by the number of year since the commitment to the GATS.

The matrix of controls variables, E_{it} , of market structure equation (i) includes the following variables: (1) **the market size** which is the main services market structure determinants underlined by Francois et al. (2002), as a large market would increase the scope for competition in the presence of scale economies. It is measured by the population size and the weight of global GDP in total Africa GDP. (2) The performances indicator to account for the simultaneity causation between performances and the introduction of competition.

The matrix of control variables in the performances model (equation (ii)), D_{sit} , includes:

i. The **price of local fixed call**, measured by the official price of a three minutes phone call in real constant dollars (at 2000 prices). Fink et al. (2003) underlined the importance of controlling for the performance of competing segment in order to capture the eventual complementary effect (economy of network). However, it is possible that the mobile and the fixed could be substitutable products, the two providing the same service. Therefore, the sign associated to fixed price could be as well negative as positive;
ii. The **Mobile price:** the expected sign is negative, as the decrease in price would allow more people to take a subscription; and
iii. Other e**xogenous factors** characterizing a country's economic structure (**income levels, population density**) identified in Boylaud and Nicoletti (2000).

4.1.2 Financial sector variables' specification

Following the literature, this chapter will assess the impact of financial liberalization in term of efficiency and credit accessibility for private sector. The study by Francois et al. (2002) measured the performance, $PERF_{it}$, in terms of market power of banks, using as indicators, the "net interest income over the total bank assets" on the one hand and the "commercial bank gross operating profit over the total banking assets" on the other. But, this does not account

for the sector efficiency, we use as alternative, the interest rate spread which account as well for the market power as for the sector efficiency.

To account for the services accessibility aspect, we use the credit to the private sector (see Clarke, Cull, and Peria, 2001)[59]. However, contrary to the previous studies, this indicator does not rely on bank-level data. This is a serious drawback, since the study will use the aggregated data at country level and then fail to control for banks specific effects which could be source of bias (see Kalirajan et al. 2000).

The market structure ($COMP_{it}$) in financial sector is measured by the level of banking concentration (Bank concentration ratio) built by Gelbard et al. (1999)[60]. It takes the values ranged from 0 to 100. A country with a value more than 50 is supposed to be in competition.

The financial **services trade openness**, LIB_{it}, is measured by a composite financial openness index built by Gelbard et al. (1999)[61]. It takes the values ranged from 0 to 100. A country with more than 50 is supposed to be opened. The table. A1-c in annex, presents the indicators or market structure and financial trade openness.

The matrix of controls variables, E_{it}, into financial market structure model, equation (i), includes the following variables: (1) Size of market, (2) and the frequency of financial crises, measured by a dummy taking one when a country has faced crisis for a particular year and zero otherwise.

The matrix of controls variables in performances model, equation (ii), D_{it}, includes: (1) The volatility of interest rate[62] and (2) the GDP per capita.

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[59] However, Gelbard et al. point to the difficulty of using this monetary indicator particularly in context of developing countries. The variable of scale for the credit to private sector is the GDP, which suffers from the weakness of national account in Africa.

[60] Bank concentration ratio: Herfindahl index applied on deposits and loans for the five largest banks.

[61] It relies on the score attributed on the base of the following question: Are there significant restrictions to the purchase of domestic financial assets by nonresidents? Is there a parallel market for foreign exchange? Are there no significant restrictions on the purchase of foreign financial assets by residents? Has the country accepted the obligations under Article VIII, Sections 2, 3, and 4 of the IMF articles of agreement? Is there an exchange tax? Are there controls on interest payments? Are there controls on profits/dividend payments? Are there repatriation requirements for service earnings? Are there controls on liquidation of direct investment?:

[62] Saunders et al. (1997) point to the interest rate volatility a strong determinant of spread. The volatility traduces the level of risks facing by the bank system and therefore justified the higher margin.

Other important determinants of the financial performance as prudential regulations (capital requirement and reserve liquid) are not introduced here because of the lack of data (see et al., 1997)

4.2 Data sources

Data for the telecommunications performance indicators are obtained from the ITU (2005b). The telecommunication liberalization indicators have been developed on the basis of ITU surveys (ITU, 2005a) and WTO schedules of commitments, while financial liberalization indicator are provided by Gelbard et al. (1999). Data on Financial performances, economic structure and growth determinants are taken from the World Development Indicators (WDI) 2005 data base of the World Bank (WB) (World Bank, 2005). Governance indicators are from Kaufman et al. (2005). The Annex Table A1a provides an overview of all variables and data sources, while the Annex tableA1b presents their statistics characteristics (number of observations, means and standard deviation).

5 Econometric issues

5.1 Methodology of simultaneous equation estimate

In order to conduct a joint estimation of the system of three equations, (i) , (ii) and (iii) containing respectively, the structure of market, performances indicators and growth as left-hand side variables respectively, we use the three-stage least squares (3SLS) estimator. Thus, the simultaneity bias is corrected for by using internal instruments. The 3SLS estimation procedure is set out in Zellner and Theil (1962): First, the exogenous variables are taken as instruments for the endogenous variables using ordinary least squares (OLS). Then, each endogenous variable is regressed on both the exogenous variables and the predictions of the endogenous variables. This is the common two stage least squares procedure (2SLS). Finally, the generalized least squares (GLS) estimator is calculated in order to use the additional information of the contemporaneous correlation of the error terms[63].

[63] In order to address different forms of endogeneity bias (due to simultaneity, omitted variables, measurement problems), the GMM estimator is the preferred method in the literature (Wooldridge, 2002). In the presence of conditional heteroskedasticity, GMM is more efficient than 3SLS.

The main advantage of using 3SLS as compared to 2SLS is an increase in the efficiency of the estimations. However, if the 3SLS is asymptotically better, they have the disadvantage that any specification error in the structure of the model will be propagated throughout the system while the 2SLS estimator will confine a problem to the particular equation in which it appears. Therefore, we will present results for the two estimators.

5.2 Over-identification problem in simultaneous equation model

For the simultaneous model considered above, the endogenous variables are over-identified. In fact for each equation included in the system, the number of excluded exogenous variable is always more than two, i.e. more than the number of endogenous variables determined in each equation considered[64].

As explained in chapter 1, the IV method of 3SLS used here considered the excluded variables as instruments and the model will be correctly identified if these variables are validate instruments. To verify this, we run the test of Hansen-Sargan for over-identifying restrictions in regression estimated via the 3SLS in which the number of instruments exceeds the number of regressors (see Baum, Schaffer and Stillman, 2006).

This is the test of the joint null hypothesis that the excluded instruments are valid instruments, i.e., uncorrelated with the error term and correctly excluded from the estimated equation. A rejection casts doubt on the validity of the instruments in 3SLS. The test computes a p-value comparing the Hansen-Sargan statistic, J, (which is the minimum value) to a criteria build by Davidson & MacKinnon (2004).

5.3 Omitted variables

The model of services performances and growth specified above may suffer from omitted variables problems[65]. More generally, to address the problem of omitted variables as well in the performances as in the growth model, all regressions will be applied the fixed effect trough the "average-difference" approach. This allows the correction of omitted variable bias for times invariant factors. Furthermore, the introduction of time dummy allows to control for

[64] Contrary to the model in chapter 1, we have not considered any supplementary endogenous variables than the dependent variables.
[65] The typical omitted variable in model evaluating the liberalization impact is the political will which would influence the effective implementation of reforms the country officially committed to.

time specific effect notably technology progress which turn out to be very determinant in telecommunication and financial sectors

In the case of financial performance model, an important omitted variable is an indicator of prudential regulation (see Saunders et al., 1997). But, the panel database for financial sector has only two periods, which makes inappropriate the usage of "average difference" method. I will counter for fixed effect by introducing five regional dummies for five main regional trade zones in Africa (CEMAC, ECOWAS, SADC, EAC and SACU).

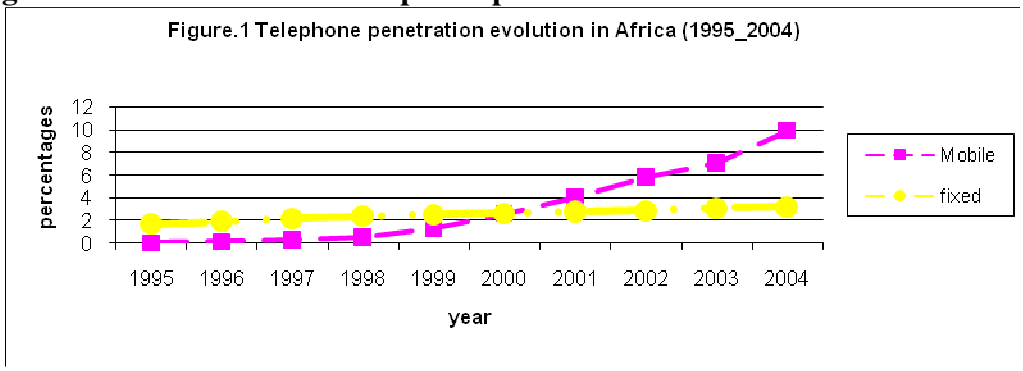
6 Regressions and results

6.1 Telecommunication results

Regressions are based on an unbalanced panel dataset for 30 African countries, over the 1995-2004 period and divided into 5 identical sub-periods. The choice of this period is essentially due to data availability; however it also coincides to the period when the major reforms in the telecommunications sector in Africa were carried out (see Djiofack and Keck, 2006).

Figure.1 below presents the evolution of telecommunication penetration in Sub Saharan Africa, between 1995 and 2004, for both the mobile and the fixed segments. It points out a boom of mobile telephony in Africa on that period, the penetration of mobile moving from less than 0.1% in 1995, on average, to 10% in 2004. Giving the poor variation of the penetration in fixed segment, which increased for only 1% between 1995 and 2004, the analysis on telecommunications will focus on mobile segment only.

Figure 1. Evolution of telephone penetration in Africa



Source: author construction from IUT (2005b) data base

The results for the simultaneous system estimate of equations from (i) to (iii) are presented in table.2. All variables are corrected from fixed effects and the system is estimated successively by 2SLS (column1) and 3SLS (column 2). The Hansen-Sargan test does not reject the null hypothesis that the internal instruments are validated (p-value =84%).

The simultaneous regressions for 2SLS (table 2 columns 1) and 3SLS (table.2 columns 2), have quite similar coefficients, and as expected the 3SLS parameters are more efficient. Thus, even if an equation in the system suffered a misspecification problem, it has no affected the whole system estimates, as result of 3SLS utilization[66].

6.1.1 Effect of services trade openness on market structure: equation (i)

As far as the equation (i) is concerned, the 3SLS estimator points to the absence of correlation between the telecommunications trade openness, as measured by the presence of GATS commitments, and penetration. While this lack of effects could be due to the low level of participation by African countries (only 13) in terms of GATS commitments in the telecommunications sector, it is in line with a study by Djiofack and Keck (2006) based on a world sample. However, the pertinence of the GATS indicator considered is to be questioned since it does not capture the differences between countries in terms of breadth (e.g. sub-sectors and modes of supply covered by the commitments) and quality of commitments.

More often stressed in the literature as important determinant of market structure (See Francois et al. 2002), the market size coefficient in the equation (i), explaining the market structure, emerges to be positive and highly significant (at 5%). More important is the economy size, the more competitive will be the telecommunications market. As a final lesson from the equation (i) estimate by the 3SLS, the assumption of the existence of a double causality between the performances and market structure is not confirmed, since the coefficient of the penetration, introduced as an explanatory variable of market structure, emerges to be negative but not significant.

[66] We have run a Hausman test of specification to compare the both models. Their coefficients turn out to be globally identical.

6.1.2 Market structure and telecommunications performances: equation (ii)

With regard to the 3SLS results, the simultaneous estimator for the equation (ii) reveals a positive (1.31) and significant (at 5%) contribution of competition, as measured by the number of operators to market penetration[67].

This is inconsistent with Doumboya's (2004) result that used a single equation model for a set of African countries and found no significant linkage between the number of operator and the penetration. However, the 3SLS result is confirmed when running a single equation as that of Doumboya (2004) with our sample[68]. In fact, Doumboya's result suffered from the lack of variability in the competition variable, since his sample (before 2000) did not cover extensively the main period where reforms were carried out in Africa. Another important outcome from the equation (ii) estimation is that, the coefficient of the fixed segment price is negative and significant, denoting a complementarities effect between fixed and mobile segments[69].

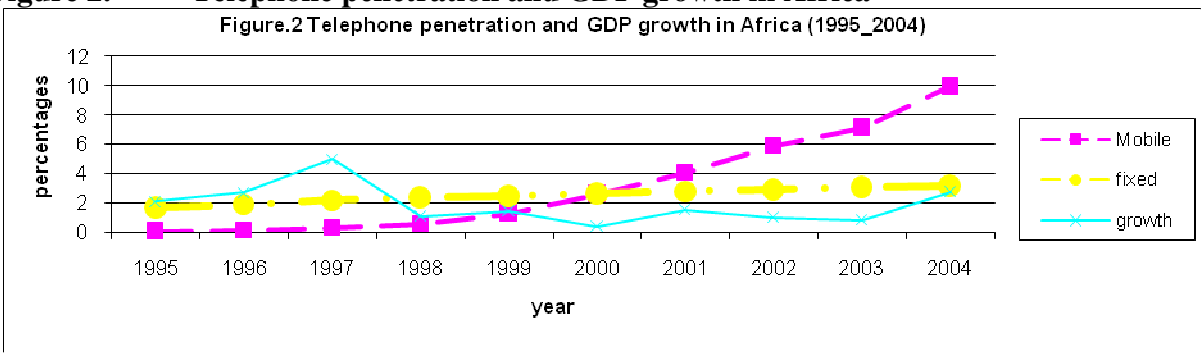
6.1.3 Growth and Telecommunications performances: equation (iii)

The previous section has set the link between the services trade liberalization (openness), market structure and the sectoral performances. We are interested now in testing whether liberalization beyond better sectoral performance of telecommunications and financial services trickles through to have an impact on economic growth.

The descriptive statistics do not show any evidence of a link between any sectoral performance indicator (penetration) and growth as illustrated in the Annex Table.A2 where the partial correlation coefficients, between growth and penetration turns out to be non significant. However, figure 2 below, displaying trends of economic growth and penetration for the Africa between 1995 and 2004, suggests a possible linkage between the two variables. In fact, while the evolutions of the penetration and growth have been opposed before 2000, they become more similar in the period after.

[67] In the performance equation, the both indicators of fixed price and the revenue, are introduced with a lag of one period, in order to account for a potential simultaneity bias.
[68] I run separately the equation (ii) using three methods: the Random effect, the fixed effect and the fixed effect corrected from the heteroskedasticity. Results are presented in annex (table.A3, column 2 to 4).
[69] This result even counterintuitive traduces the possibilities of network economy in telecommunication sector.

Figure 2. Telephone penetration and GDP growth in Africa



Source: author construction from ITU (2005b) database

The 3SLS estimation of the growth model equation (iii), points to the positive (0.012) and highly significant (at 1%) coefficient for the penetration variable[70] (see table 2 below). This result is the validation of the existence of a reverse relationship between growth and penetration, as the coefficient of the per capita income introduced as explanatory variable in penetration model (equation ii) is positive and highly significant (at 1%). This outcome is consistent with the Sridhar and Sridhar (2004) study on a set of developing countries. However, our income elasticity of demand for cellular services, (**9.77**), is very far from the Sridhar and Sridhar finding, 1.15, for all telecommunications services (including fixed and mobile).

To conclude, even if the international commitment does not contribute to the competition in telecommunication market, enhancing the market structure to 1 percent lead to an increase of (1.31) percent of accessibility to the mobile telephony services. And the augmenting by 1 per cent of the services accessibility translates into a 0.012 per cent higher level of real GDP per capita in Africa. This result is strongly consistent with previous findings especially that of Sridhar and Sridhar (2004), who found that for every 1 per cent increase in cell phone penetration, national output increases by 0.01 in developing countries.

[70] The result is confirmed when estimating the equation (iii) separately and using alternatives techniques. We estimate the equation (iii) in random and fixed effects corrected from heteroskedasticity. The Annex Table.A4 column (4 and 5) gives the results. They point to the positive and highly significant (at 1%) coefficient for the penetration variable. In order to test, if there is any direct link between the competition and the growth, we introduced in the equation (iii) the competition indicator (number of operator). The results of news estimates are in Annex table.A4 (column 1 to 3). The penetration coefficient is still positive and significant. In opposite, the market structure coefficient turn out to be non significant whatever the techniques used (random or fixed effect).

Table 2. Simultaneous regressions of growth and telecommunications performances model

	(1)	(2)
	2SLS	**3SLS**
(i)		
	Number operator	**Number operator**
Penetration	**-0.034**	**-0.017**
	(0.38)	**(0.21)**
Telecom regulation	-0.020	-0.012
	(0.25)	(0.16)
Market size	**0.050**	**0.050**
	(2.17)**	**(2.28)****
Population	1.727	1.272
	(0.75)	(0.59)
Telecom services openness	**-0.032**	**-0.034**
	(1.05)	**(1.20)**
Constant	0.013	0.012
	(0.37)	(0.36)
(ii)		
	Penetration	**Penetration**
GDP/capita	**9.227**	**9.771**
	(2.09)**	**(2.51)****
Density	10.249	9.739
	(3.20)***	(4.03)***
Lag fixed price	-0.091	-0.103
	(1.46)	(2.35)**
Lag mobile price	-0.152	-0.031
	(0.90)	(0.25)
Number of operators	**1.173**	**1.312**
	(1.61)	**(2.27)****
Year	0.257	0.260
	(2.98)***	(3.92)***
Constant	-514.004	-518.987
	(2.98)***	(3.92)***
(iii)		
	GDP/capita	**GDP/capita**
Penetration	**0.014**	**0.012**
	(3.09)***	**(3.15)*****
Investment	0.027	0.053
	(0.83)	(2.24)**
Population	-0.019	0.001
	(1.07)	(0.09)
Trade openness	0.041	0.041
	(1.15)	(1.58)
Life expectancy	0.116	-0.055
	(0.80)	(0.53)
Inflation	0.005	0.008
	(0.70)	(1.71)*
Institutions	1.262	1.256
	(0.75)	(1.02)
Tertiary education	0.039	0.056
	(1.35)	(2.60)***
Lag of GDP/capita	1.56	1.43
	(6.60)***	(8.60)***
Constant	0.002	0.005
	(0.26)	(0.97)
Observations	97	97
Countries :30 X 5	30	30
Hansen-sargan pvalue	J=24.773 H0: Chi-sq(26), pval = 0.53	J=18.862 H0: Chi-sq(26), pval = 0.84
R-squared	0.27-0.12-0.80	0.27-0.12-0.80

Absolute value of t statistics in parentheses

significant at 10%; ** significant at 5%; * significant at 1% (i) indicates the bloc of variables included in competition equation; (ii) Indicates the bloc of variables included in performance equation; (iii) indicates the bloc of variables included in growth equation.*

6.2 Financial sector estimates

Financial sector regressions are based on a database from 1980 to 2000 on 33 African countries and divided into two periods. The choice of both periods is constrained by the availability of the variable of interest, the policy indicators, which are only available for the years 1987 and 1997. I will assume that the policy indicators of 1987 represent the situation of the 1980s, while that of 1997 represent the 1990s[71].

6.2.1 Descriptive statistics

Before regressions results, it is instructive to analyze some descriptive statistics relative to African financial sector. Table.3 summarizes the differences in average performances (interest rate spread and credit to private sector) between non competitive and competitive markets, on the one hand, and between the 1980s and the 1990s on the other. The results in the table point to the deterioration of financial performances between the 1980s and 1990s, as the interest rate spread has significantly increased, while the credit to private sector slowed. This evolution traduces logically the state of crisis which characterized many African financial economies during the1990s as illustrated by the figure.3, below.

Table 3. Average differences of financial sector performances

	1980s VS. 1990s	Non competition Vs. Competition
Credit to private sector	**Decrease**	**Increase**
Spread	**Increase**	**Unchanged**

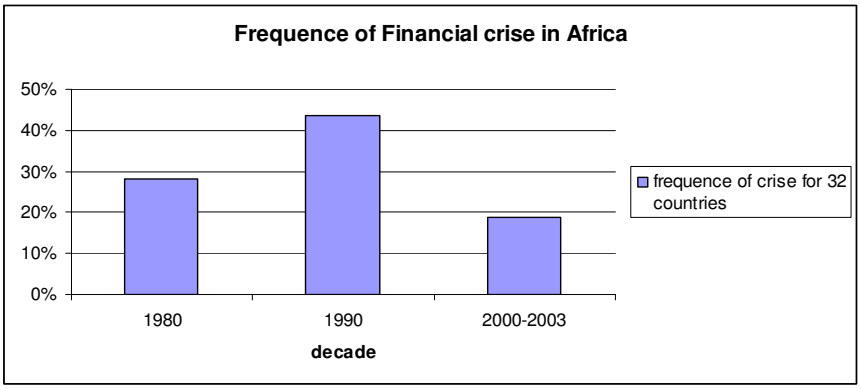
Source: author construction

The performances comparison between non competitive and competitive markets shows an increase in ratio of credit to private sector. A result which is confirmed in Annex Table.A7, show a positive partial correlation between market structure and credit to private sector. This outcome matches our expectation that the improvement of market structure would enhance the credit to private sector.

[71] The annex (Table. A1-c) provides the list of countries involved in financial regressions with the relevant financial liberalization indicators.

However, the second financial performances indicator, the interest rate spread, has no link with the introduction of competition, as the comparison between non competitive and competitive shows no change.

Figure 3. Frequencies of financial crises in Africa



Source: author construction

Concerning the financial performance and growth relationship, the Table.4 summarizes the differences in average income growth and performances (interest rate spread and credit to private sector) between, on the one hand, non competitive and competitive markets and between the 1980s and the 1990s on the other. Comparisons built in the table.4 point to the absence of variation in income growth between 1980s and 1990s, while the countries with competitive financial market structure emerge as the better growth performer.

Table 4. Growth and Performances evolution

	1980s VS 1990s	Non competition Vs Competition
GDP Growth	**Unchanged**	**Increase**
Credit to private sector	**Decrease**	**Increase**
Spread	**Increase**	**Unchanged**

Source: author construction

Comparing the growth and the evolution of sectoral performances throughout the time, the GDP growth has not common trend with any of financial performances between 1980s and 1990s. The performances have deteriorated while the growth globally remains unchanged between the two periods. However, when this comparison is set up on the perspective of competition introduction, a common pattern emerges between the income growth and the credit to private sector ratio. In fact, the both credit to the private sector and the growth performance are better in countries with competitive market

6.2.2 Regressions results

The results for the simultaneous system estimate of equations from (i) to (iii) are presented in table.5, below, for the financial sector.

Table 5. Simultaneous regressions of growth and financial performances model

	(1)	(2)	(3)	(4)
	2SLS	**3SLS**	**2SLS**	**3SLS**
(i)				
	Competition	**Competition**	**Competition**	**Competition**
Financial openness	**0.358**	**0.358**	**0.323**	**0.295**
	(3.15)* **	**(3.57)*** **	**(2.65)*** **	**(2.82)*** **
Spread	-0.059	-0.050		
	(0.44)	(0.42)		
Credit private sector			0.067	0.086
			(0.75)	(1.09)
Market size	0.078	0.078	0.061	0.084
	(1.74)*	(1.97)**	(1.76)*	(1.85)*
Time	0.133	0.125	0.091	0.105
	(0.84)	(0.89)	(0.73)	(0.96)
Constant	2.901	2.896	2.744	2.880
	(7.23)***	(8.19)***	(5.98)***	(7.26)***
(ii)				
	Spread	**Spread**	**Credit**	**Credit**
GDP/capita	-0.058	-0.049	0.489	0.453
	(0.67)	(0.64)	(4.51)***	(4.90)***
Interest instability	0.264	0.265	-0.444	-0.431
	(2.83)***	(3.23)***	(3.81)***	(4.28)***
Competition	0.312	**0.272**	-0.125	**0.142**
	(0.91)	**(0.92)**	(0.29)	**(0.40)**
Time	0.816	0.826	0.012	-0.054
	(4.60)***	(5.32)***	(0.05)	(0.28)
Constant	-0.908	-0.823	1.083	0.299
	(0.69)	(0.72)	(0.66)	(0.21)
(iii)				
	GDP/capita	**GDP/capita**	**GDP/capita**	**GDP/capita**
Spread	**-0.362**	**-0.388**		
	(1.55)	**(1.75)***		
Credit private sector			**0.124**	**0.140**
			(1.62)	**(1.89)***
Tertiary education	0.388	0.319	0.368	0.386
	(2.18)**	(2.30)**	(2.51)**	(3.43)***
Life expectancy	1.219	2.115	1.991	1.815
	(0.64)	(1.41)	(1.84)*	(2.21)**
Population	-25.016	-17.729	-21.774	-28.097
	(1.13)	(1.03)	(1.33)	(2.24)**
Lag of GDP/capita	0.280	0.257	0.284	0.248
	(3.00)***	(3.50)***	(3.35)***	(3.76)***
Trade openness	0.095	0.218	0.112	0.115
	(0.35)	(1.03)	(0.47)	(0.61)
Inflation	-0.044	0.026	0.047	-0.005
	(0.14)	(0.11)	(0.33)	(0.04)
Institutions	0.091	0.072	0.086	0.155
	(0.79)	(0.80)	(0.84)	(1.93)*
Time	-0.637	-0.560	-0.262	-0.272
	(0.72)	(0.79)	(1.21)	(1.56)
Constant	-1.532	-5.566	-4.466	-4.604
	(0.20)	(0.92)	(0.91)	(1.22)
Observations	50	50	50	50
Hansen-sargan pvalue	J= 17.35 H0: Chi-sq(16), pval = 0.3849	J= 18.436 H0: Chi-sq(16), pval = 0.2849	J= 19.35 H0: Chi-sq(16), pval = 0.172	J= 20.436 H0: Chi-sq(16), pval = 0.0.949
R-squared	0.76-0.51-0.43	0.74-0.50-0.42	0.81-0.54-0.42	0.80-0.52-0.40

*significant at 10%; ** significant at 5%; *** significant at 1% (i) indicates the bloc of variables included in competition equation; (ii) Indicates the bloc of variables included in performance equation; (iii) indicates the bloc of variables included in growth equation.

The fixed effect is account by introducing 5 regional dummies and a time dummy. For each performance each of the two financial performance indicators considered in this study, the system is estimated successively by 2SLS and the 3SLS (column 2). The estimate including the credit to private sector are reported in (columns 1 and 2), while those including the interest rate spread are in (columns 3 and 4).

The Hansen-Sargan test does not reject the null hypothesis that the internal instruments are validated for any of the four system specifications[72].

6.2.2.1 Financial liberalization and market structure: equation (i)

Contrary to the telecommunication, the 3SLS estimator of equation (i) shows a positive and significant effect of financial services trade openness on the sectoral competition. This holds whatever the performances indicator or the estimator (2SLS, or 3SLS) considered. An openness equivalent to one point will translate into 0.30 to 0.36 (depending on specification) points of market structure amelioration.

As in the telecommunication sector, the size of the market emerges as an important determinant of market structure.

6.2.2.2 Market structure and sectoral performances: equation (ii)

The 3SLS estimator of financial performances equations reveals unexpected results, as the market structure indicator emerge to be insignificant. This holds whatever the performance indicator considered. If these results do not match the expectations, they are in line with descriptive statistics observation, as the partial correlation between market structure and the financial performance is not significant (see Annex Table A.7). The same result is found when estimating separately the equation (ii)[73].

This outcome comes in opposition to the previous studies on developed countries (See Saunders and Shumacher, 1997) as well as those on developing countries (see Clarke, Cull &

[72] The simultaneous regressions for 2SLS and 3SLS have quite similar coefficients, and as expected the 3SLS parameters are more efficient. Thus, even if an equation in the system suffered a misspecification problem, it has no affected the whole system estimates, as result of 3SLS utilization.

[73] We estimate separately the equation of performance (ii), using the OLS on poling data (see Annex table.A8)

Peria 2001). However, it is consistent with a recent study by Mattoo et al. (2006) on Zambia[74].

Nevertheless, the absence of an effect of market structure on performances could be due to the quality of competition indicator used. The banking concentration, used here, is an output indicator, and it is conceivable that it does not reflect the quality of the actual policy. In fact, a financial system could be very concentrated while functioning under competitive rule, if the actual policy allows contestation from foreign banks. To account for this issue, we have directly included in the performances model, equation (ii), the indicator of financial services trade openness to traduce contestability. However, the estimation in Annex Table A.8 (column 3 and 4) does not show any significant link between financial services trade openness and performance indicators.

Another possible explanation of the lack of effect of competition is that the estimation may also suffer from the omitted variables issue. Notably the quality of the prudential regulation in financial system, which emerged in previous studies as important determinant of performances (see Kalijaran et al, 2000) and could, therefore, conditioned the effect of competition introduction. Due to the lack of an indicator of financial regulation, we account for this omitted issue by introducing in the equation (ii) an "output indicator" of the financial crisis. This variable take 1 when a country for a particular year faced the financial crisis and zero otherwise. The new equation (ii) is estimated separately. But the results in table A8 column (5 and 6) show not significant link between financial crisis and any of performances indicators. More importantly, the coefficients of competition indicator remain non significant.

6.2.2.3 Growth and Financial performances

When considering the estimation of the growth model of equation (iii), the results show that all controls variables are significant with expected signs (except inflation). As far as performances indicators are concerned, the results point to the significant coefficients with the expected signs for the both credit to private sector and interest rate spread. An increase of 1 point in credit to private sector would be translated into 0.140 points of income growth

[74] In the case of Zambia, Mattoo et al. (2006) explained the poor sectoral performance by the "eviction effect", as the state massively solicited bank to finance their fiscal deficit, this detrimental to private. They also point to the inappropriate sequence of reforms, as the liberalization took place before establishing a new legal and regulatory framework for the banking system that would encourage prudent risk-taking and market discipline.

improvement, while the decrease of 1 point in interest rate spread would generate an improvement of 0.38 points of income growth. These results hold when estimating separately the equation (iii)[75].

As final outcome from the 3SLS estimator of the system, the assumption of existence of the reverse causality between the credit to private sector and the income growth is validated. The coefficient associated to the GDP variable in equation (ii) with credit to private as left hand-side variable is positive and significant. But, this assumption is not validated when the financial performance is the interest rate spread.

Summarizing, the financial services trade openness contributes to the strengthening of the competition, as measured by the banking concentration. But, contrary to Francois et al. finding, the banking concentration reduction does not lead to the amelioration of financial performances in terms of access to the credit and in term of efficiency and market power (interest rate spread) reduction. Nevertheless, the financial sector performances emerge as significant determinants of income growth.

6.3 Discussion

6.3.1 GMM as alternative to 3SLS in growth model

As an alternative method to correct for possible endogeneity problems linked to simultaneity bias, to measurement errors or omitted variables, we run the growth model regressions using the Generalized Method of Moments (GMM) estimator, i.e. we have estimated a dynamic panel in first differences using lagged values of the endogenous variables as instruments[76].
The model specification is a follows:[77]

$$\log Y_{it} = \lambda_3 \log Y_{i(t-1)} + b_3^s + \alpha_3^s \log PERF_{it}^s + \beta_3^s \log C_{it}^s + u_i^s \qquad \text{(xxii)}$$

The dynamic GMM model shows a positive and significant correlation between penetration and growth. This method allows accounting for endogeneity of others growth determinants (Investments, inflation and education) by generating internal instruments as discussed above.

[75] We estimate separately the equation (iii) using an OLS estimator on pooling data Results in Annex Table.A9. The above results hold, whatever introducing separately the interest rate spread (column 1) and the credit to private sector (column 2), or when introducing the both indicators simultaneously (column 3).
[76] This method is not applied for financial sector since its data include only two periods.
[77] This specification applies to the GMM estimation; the alternative estimation methods do not include lagged GDP as an explanatory variable.

The result in Annex Table.A5 shows a coefficient between growth and penetration which is far smaller (0.008) compare to the 3SLS estimate (0.012) and less significant (5% compared to 1% in 3SLS).

6.3.2 Stability of liberalization effects in respect to development level

There is an important concern in the literature about the linearity of liberalization effects with respect to the development level. Claessens, Demirgüç-Kunt and Huizinga (2001) note that the comparative functions of foreign banks and domestic banks are very different in developing and industrial countries, possibly because of a different customer base, different bank procedures, and different regulatory and tax regimes. Using the same sample as Mattoo et al. (2006), EL Khoury and Savvides (2007) established through the Hansen's (2000) "Threshold Model" the evidence of the existence of a threshold level of development in the relationship between services trade liberalization and growth. In the case of financial services, they point to the positive and significant contribution of liberalization for the most developed countries (above the threshold) and the absence of effect for less developed countries (below the threshold). The scheme is reverse for the telecommunication, lest developed countries gaining while the most developed enjoy no effect.

To test the stability of the services effects, I reconsider the simultaneous model of growth including equations (i to iii). In each equation, we introduce successively a multiplicative variable, called "development threshold", which is the multiplication of the main interest variable of the equation by the initial GDP per capita[78].

This specification is run in three different samples: Africa, Developing Countries and World. If the development threshold variable for a given equation emerges significant, then we conclude to the existence of a threshold in the effects. The results are reported in annex table-A6 for the telecommunications and table.A10 for the financial services.

6.3.2.1 Development threshold

For telecommunication sector, the results in the Annex table.A6 (column 1 and 2) show no evidence of threshold existence based on development level, as well for the relationship

[78] The interest variables are the openness (liberalization) for equation (i), the level of competition (market structure) for equation(ii), and the sectoral performances for equation (iii).

between growth and penetration as for the relationship between the market structure and the sectoral performances. This result holds in both Africa and world sample.

Concerning the financial sector, there is no evidence of financial trade openness effect variability in respect to the development level. However in opposite to the telecommunications sector, the market structure effect on sectoral performances and the effects of sectoral performances on income growth seem to be dependent to the development level, the less developed among African countries gaining significantly more. This result holds, whether, the performances indicator is measured by credit to private sector or the interest rate spread.

6.3.2.2 Africa specificities in telecommunications sector

We then substitute the "development threshold" by a new multiplicative variable named "Africa Threshold" which is the multiplication of the main interest variable by the Africa dummy. That variable is introduced successively in a developing countries and world sample. The estimate allows perceiving an Africa particularity in term of telecommunications effects, compared to developing and the world. The results in the Annex table.A6 column (3 and 4) show evidence of a higher impact of market structure in penetration and a lesser impact of penetration on growth compared to developing countries and the world. This result is in line with Sridhar and Sridhar (2004) study, which evidence a higher growth effects of penetration in developed countries compared to developing one.

7 Conclusions

This study has assessed the indirect linkage between trade liberalization in financial and telecommunications services and income growth, relying on a causality chain model based on Francois and Eschenbach (2002) and Bayraktar and Wang (2006). This includes the following three stage of causation: (1) Services trade liberalization contributes to reduce the concentration in market structure, (2) which reduces market power and then contributes to the sectoral performances, (3) which in turn encourages higher economic growth.

Our empirical assessment is based on the South Saharan African data from 1995 to 2004 for telecommunications services and from 1980 to 2000 for financial services. The estimates point to mitigate results. In telecommunications sector, the services trade openness, as measured by the country commitments in the framework of General Agreements of Trade in Services (GATS) at WTO, shows no correlation with the competition level (number of operators). However the level of competition has a strong effect on telecommunications services accessibility, which in turn influences significantly income growth.

As an important robustness test of the results, the estimates show evidence of the coefficients stabilities, in respect to development level among Africa countries. Furthermore, the results evidence, as in previous studies (see Sridhar and Sridhar, 2004), a higher impact of services trade competition on penetration and a lesser important influence of penetration on growth in Africa, compared to the rest of the world.

In the case of the financial sector, trade liberalization, as measured by the openness of cross-border operators and operations (See Gelbard et al, 1999), emerges to be a strong determinant of market competitiveness, as measured by the level of concentration. However, the level of competition in the financial market shows no significant link with the sectoral performances whatever, the later is measured by the level of credit to private sector or by the interest rate spread. As the last stage in the Francois et al. causality chain, the sectoral performances indicators emerge as strong determinants of income growth.

As an important difference with the telecommunications sector, the financial performances effect on growth seem to be correlated to the development level, among Africa countries, the less developed countries enjoying the higher gain.

Finally, the results evidence, like in previous studies, a double causation between growth and sectoral performances (see Sridhar and Sridhar, 2004). This holds for the both telecommunications and financial sectors (when the performance is measured by credit to private sector).

There is, nonetheless, no evidence of complete causality chain of Francois et al, the only recurrence being the positive effect of sectoral performances and the growth, whatever the services considered.

Further research on this topic should improve the trade openness indicator, notably the commitment in the framework of the GATS which should account for the breath dimension. In addition, the role of regulation should be more stressed. It should be particularly instructive, in respect to the consumer's welfare, to assess the regulation influence on providers' market power when determining the price of services access.

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Annexes

Table A1. -a Data description and sources

Variable	Description	Source
Price mobile	Costs of 3 minutes call from one mobile to another; annual bill of average subscriber	ITU
Price local fixed	Costs of 3 minutes call from local fixed line; annual bill of average subscriber	ITU
Price international fixed	Costs of 3 minutes call to the United States	WDI
mobile Penetration	Percentage of population subscribed and having telephone service activated within the last 9 months	ITU
fixed Penetration	Percentage of population subscribed	ITU
Unilateral openness	Number of operators per segment	ITU
Unilateral regulation	Independence score of the regulatory authority multiplied by the numbers of years in existence	ITU
Multilateral openness	GATS commitments score	WTO
Multilateral regulation	Reference Paper score	WTO
Quality of telecom services	Share of digital lines per segment	ITU
Income	GDP per capita	WDI
Population density	Percentage of population per square kilometer	WDI
Population size	Total number of inhabitants, urban population	WDI
Governance	(1) Kaufmann governance indicators: regulatory quality, policy stability, corruption control; (2) Freedom Political Rights	(1)WB; (2)Freedom House
Other growth determinants	Ratio of secondary schooling, share of exports in GDP, inflation, gross fixed capital formation, labour force	WDI

Table. A1-b. Summary variables (Bi-annual data)

Variable	Obs	Mean	Std. Dev.	Min	Max
GDP/capita	145	853.02	1326.88	56.52	7618.54
GDP/capita growth	145	1.88	7.48	-31.65	89.83
Penetration	147	3.19	7.97	0.00	68.04
Investments	142	20.59	11.23	1.80	113.58
Tertiary education	140	3.11	2.91	0.00	18.54
Pop growth	140	2.46	1.14	-1.66	10.21
Life expectancy	143	49.36	8.52	31.69	72.95
Trade openness	145	76.20	39.71	12.80	275.23
Inflation	145	44.45	321.17	-24.08	5399.53
Operator (market structure of mobile)	144	1.91	0.88	1.00	3.00
Market size	145	-11.73	3.05	-32.24	-5.39
Governance	140	-0.01	0.01	-0.03	0.01
Population	150	1.37E+07	2.03E+07	7.53E+04	1.29E+08
Telcom regulation quality	142	0.70	0.88	0.00	3.56
Reference paper	140	0.18	0.55	0.00	2.00
Liberalization telecom (GATS commitments)	140	0.23	0.42	0.00	1.00
Density	150	72.61	101.22	2.00	608.00
Mobile price	144	0.60	0.49	0.00	3.15
Fixed price	148	0.11	0.09	0.01	0.70

Table. A1-c: financial liberalization indicators

countries		Financial services trade openness		Liberalization of credits interest rate interest		Market structure (concentration de depot et du credit)	
		1987	1997	1987	1997	1987	1997
Angola*	1	15	23	0	23	31	31
Benin	2	38	77	20	43	65	74
Botswana	3	54	46	20	65	76	92
Burkina Faso	4	38	69	20	73	63	78
Cameroon	5	15	46	40	39	58	59
Cape Verde	6	38	62	0	47	26	41
Comores	7	38	62	20	27	55	56
Central African Rep.	8	31	46	20	23	40	41
Congo	9	31	62	20	63	15	27
Cote d'Ivoire	10	54	85	20	68	58	71
Eritrea*	11	31	54	0	3	38	39
Ethiopia*	12	15	23	0	7	19	41
Gabon	13	54	77	20	64	62	77
Gambia, The	14	62	85	44	69	62	62
Ghana	15	38	85	20	45	66	79
Eqatorial Guinée	16	31	62	20	69	47	57
Guinea	17	31	54	20	63	62	72
Guinea-Bissau	18	54	92	20	30	62	63
Kenya	19	77	100	20	77	47	56
Lesotho	20	23	46	20	52	40	52
Madagascar	21	54	69	20	61	57	68
Malawi	22	31	46	20	43	56	62
Mali	23	31	77	20	68	43	58
Mauritius	24	92	100	60	86	61	76
Mozambique	25	38	62	0	63	69	82
Namibie	26	38	69	20	71	75	88
Niger	27	54	85	20	67	58	73
Nigeria	28	23	54	20	40	67	82
Sao Tome e Principe*	29	38	54	20	40	23	38
Senegal	30	31	62	20	70	47	62
South Africa	31	62	62	60	93	93	93
Swaziland	32	62	77	40	63	62	63
Tanzania	33	46	85	20	68	49	56
Togo	34	46	77	20	68	54	70
Uganda	35	46	92	20	67	59	71
Zambia	36	62	85	20	67	67	68
Zimbabwe	37	23	62	20	57	69	73

Source : Gelbard et al. (1999

Note: indicates the countries which are not included in our regressions*

Table A2. Descriptive statistics related to telecommunications regressions

	GDP growth	Popgrowth	Invest	Fixed price	Mobile price	openness	Live expectancy	Tertiary education	Gats	Reference paper	Nber inter operators	Nber mobile operators	Number fixed operator	**Penetration mobile**	**Penetration Of fixed**	**GDP**	M3
GDP growth	**1**																
Pop-growth	**-0.0034**	1															
Investment	**0.1097**	0.0018	1														
Fixed price	**-0.0471**	0.0262	0.4640*	1													
Mobile price	**-0.1862***	0.1750*	0.4884*	0.9013*	1												
openness	**0.3309***	-0.1982*	0.1392*	0.1217	0.0486	1											
Digital mobile penetration	**0.0171**	-0.1762*	0.055	-0.069	-0.0691	-0.0754											
Live expectancy	**0.0379**	0.0005	0.0238	0.1008	0.0167	0.2513*	1										
Tertiary education	**-0.0201**	-0.5401*	0.2457*	-0.1036	-0.136	0.4943*	0.4246*	1									
Gats comittments	**-0.1483***	-0.1385*	0.1750*	0.1323*	0.2172*	0.1343*	-0.059	0.0613	1								
Reference paper	**-0.0256**	-0.083	0.0492	-0.1109	-0.0695	-0.0618	0.1026	0.1299	0.5546*	1							
Nber international oper	**-0.1994***	0.0124	-0.0808	-0.0597	-0.1296	0.0313	-0.0659	0.1196	0.093	0.0026	1						
Nber mobile oper	**-0.1568***	-0.1358*	-0.0017	-0.1308*	0.0216	-0.1455*	-0.1495*	0.0688	0.1561*	0.1113	0.4022*	1					
Nber fixed oper	**-0.1656***	-0.0109	-0.0884	-0.0847	-0.1291	-0.0538	-0.0585	0.0761	0.1342*	-0.0088	0.7519*	0.2767*	1				
Penetration mobile	**-0.0336**	**-0.3802***	**-0.0763**	**-0.0976**	**-0.1205**	**0.2893***	**0.2740***	**0.8278***	**0.0033**	**0.1011**	**0.1599***	**0.1475***	**0.1223***	**1**			
Penetration fixe	**0.021**	**-0.3612***	**-0.0346**	**-0.0875**	**-0.1099**	**0.3899***	**0.6657***	**0.8536***	**-0.0798**	**0.0437**	**-0.0391**	**-0.0111**	**-0.0595**	**0.6940***	**1**		
GDP	**0.2841***	-0.016	0.2842*	0.8529*	0.8197*	0.3485*	-0.0302	-0.0198	-0.0272	-0.0706	-0.0957	-0.0986	-0.1081	**0.0384**	**-0.025**	**1**	
lnM3	**-0.1240***	-0.2417*	-0.0934	0.1139	0.1045	0.3402*	0.5458*	0.6044*	0.0731	0.0153	-0.0787	-0.0437	-0.1197*	**0.4778***	**0.7371***	**-0.0829**	1
Population	**-0.0514**	-0.0168	0.1610*	-0.1868*	0.0091	-0.2611*	-0.2001*	-0.1029	0.2631*	0.1353*	0.1541*	0.1240*	0.2894*	**-0.0807**	**-0.1735***	**-0.1377***	-0.1069
popurbaine1	**-0.0151**	-0.1838*	0.0987	0.2666*	0.2977*	0.2532*	0.3562*	0.3646*	0.3556*	0.2112*	0.0065	0.1567*	0.0214	**0.3091***	**0.2826***	**0.1928***	0.2089*
Policy stability	**0.2010***	-0.2045*	-0.1498*	-0.0541	-0.1860*	0.2882*	0.3763*	0.4653*	-0.1290*	0.0232	-0.3215*	-0.0666	-0.4618*	**0.3115***	**0.4395***	**0.0504**	0.4018*
Nation Quality regulation	**0.018**	-0.2683*	-0.1697*	-0.1351*	-0.1139	0.1712*	0.4027*	0.5837*	-0.018	0.2026*	-0.3279*	-0.0407	-0.3998*	**0.3455***	**0.5567***	**-0.1404***	0.4924*

Table A3. Mobile penetration and number of operator

	(1)	(2)	(3)	(4)
	RE	**FE**	**FE-H**	**FE-H**
	Penetration	**Penetration**	**Penetration**	**Penetration**
Density	0.150	9.452	9.452	8.074
	(1.63)	(3.66)***	(4.98)***	(4.41)***
Number operator (competition)	**0.593**	**0.574**	**0.574**	**0.465**
	(3.23)* **	**(2.84)*** **	**(2.84)*** **	**(2.54)** **
Lag GDP/capita	**1.255**	**-0.806**	**-0.806**	**-0.448**
	(10.82)* **	**(0.65)**	**(0.61)**	**(0.33)**
Lag Mobile price	0.156	0.180	0.180	
	(1.37)	(1.26)	(1.14)	
Lag fixed price	-0.200	-0.140	-0.140	0.010
	(1.86)*	(0.96)	(1.01)	(0.12)
Time	0.581	0.448	0.448	0.452
	(17.24)***	(7.05)***	(9.03)***	(10.12)***
Constant	-1,170.759	-927.019	-927.019	-931.012
	(17.44)***	(7.86)***	(9.94)***	(11.23)***
Observations	125	125	125	137
Number of group	30	30		
R-squared		0.89	0.95	0.95

Absolute value of z statistics in parentheses
significant at 10%; ** significant at 5%; *** significant at 1%
RE:Random effect; FE:Fixed effects; FE-H: Fixed effects corrected from heteroskedasticity

Table A4. Growth and telecom performances

	(1)	(2)	(3)	(4)	(5)
	RE	**FE**	**FE-H**	**FE**	**FE-H**
	GDP/capita	**GDP/capita**	**GDP/capita**	**GDP/capita**	**GDP/capita**
Penetration	**0.013**	**0.013**	**0.013**	**0.013**	**0.013**
	(2.72)* **	**(3.46)*** **	**(3.61)*** **	**(3.46)*** **	**(3.61)*** **
Competition (number operators)	**-0.004**	**-0.004**	**-0.004**		
	(0.16)	**(0.22)**	**(0.23)**		
Investments	0.019	0.010	0.010	0.010	0.010
	(0.50)	(0.34)	(0.23)	(0.34)	(0.23)
Lag pop growth	-0.063	-0.027	-0.027	-0.027	-0.027
	(1.60)	(0.87)	(0.94)	(0.87)	(0.94)
Life expectancy	0.218	0.022	0.022	0.022	0.022
	(1.05)	(0.14)	(0.21)	(0.14)	(0.21)
Trade openness	0.165	0.152	0.152	0.152	0.152
	(4.00)***	(4.76)***	(5.04)***	(4.76)***	(5.04)***
Inflation	0.004	0.001	0.001	0.001	0.001
	(0.47)	(0.13)	(0.14)	(0.13)	(0.14)
Tertiary education	0.088	0.053	0.053	0.053	0.053
	(2.35)**	(1.79)*	(1.77)*	(1.79)*	(1.77)*
Lag of GDP/capita	1.05	1.15	1.16	1.15	1.15
	(6.00)***	(5.76)***	(6.04)***	(5.76)***	(6.04)***
Constant	4.405	5.301	5.301	5.301	5.301
	(5.69)***	(8.69)***	(12.54)***	(8.69)***	(12.54)***
Observations	116	116	116	116	116
Number of group	30	30		30	
R-squared		0.46	1.00	0.46	1.00

Absolute value of z statistics in parentheses
significant at 10%; ** significant at 5%; *** significant at 1%

Table A5. GMM growth regression on penetration

	GDP/capita
Lag **GDP/capita**	1.013
	(22.83)***
Mobile Penetration	**0.008**
	(1.83)*
Population growth	0.015
	(0.62)
Investments	0.041
	(1.27)
Life expectancy	0.102
	(0.63)
Inflation	-0.013
	(1.81)*
Telcom market structure	**-0.035**
	(1.05)
Governance	4.601
	(1.02)
Trade oponness	0.028
	(0.62)
Tertiary education	-0.049
	(1.38)
Constant	-0.577
	(0.81)
Observations	136
Number of group	30

Robust t statistics in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

Table A6. Robustness of liberalization effect (3SLS regressions)

	(1)	(2)	(3)	(4)
	Africa	**World**	**Developing countries**	**World**
(i)	**Operator**	**Operator**	**Operator**	**Operator**
Penetration	0.298	0.102	0.108	0.134
	(4.74)***	(3.18)***	(3.78)***	(4.81)***
Telecom regulation	0.011	0.043	0.056	0.072
	(0.17)	(1.50)	(1.82)*	(2.24)**
Market size	0.014	0.017	0.020	0.007
	(0.80)	(1.72)*	(1.89)*	(0.64)
Population	-5.932	-1.001	-1.421	-2.204
	(3.42)***	(1.38)	(2.08)**	(3.15)***
Telecom openness (gats commitments)	-0.042	-0.042	-0.042	-0.038
	(0.67)*	(0.74)	(5.51)	(0.15)
Constant	0.014	-0.007	-0.006	-0.004
	(0.45)	(0.45)	(0.43)	(0.23)
(ii)				
	Penetration	**Penetration**	**Penetration**	**Penetration**
GDP/caita	4.658	0.687	0.234	3.795
	(1.43)	(0.43)	(0.15)	(2.46)**
Africa			**-0.018**	**-0.013**
			(0.27)	**(0.20)**
Density	10.025	2.337	2.851	4.864
	(5.19)***	(2.73)***	(3.11)***	(4.33)***
Fixed price	-0.190	0.042	0.030	0.063
	(1.69)*	(0.81)	(0.55)	(1.14)
Mobile price	0.102	-0.102	-0.108	-0.123
	(1.02)	(1.91)*	(1.94)*	(2.21)**
Competition (number operators)	1.576	1.741	0.562	0.262
	(7.95)***	(9.42)***	(0.91)	(0.37)
Time	0.297	0.389	0.391	0.341
	(6.05)***	(10.24)***	(9.97)***	(8.17)***
Competition*Africa			**0.972**	**1.163**
			(1.60)*	**(1.69)***
Competition*initialGDP	**0.102**	**0.211**		
	(0.30)	**(0.55)**		
Constant	-594.244	-776.998	-781.579	-682.295
	(6.05)***	(10.23)***	(9.97)***	(8.17)***
(iii)	**GDP/capita**	**GDP/capita**	**GDP/capita**	**GDP/capita**
Penetration	**0.014**	**0.033**	**0.042**	**0.034**
	(3.66)* **	**(10.68)*** **	**(10.56)*** **	**(7.69)*** **
Investment	0.041	0.018	0.026	0.019
	(1.82)*	(0.80)	(1.22)	(0.86)
Pop growth	-0.003	-0.006	-0.004	-0.027
	(0.22)	(0.87)	(0.57)	(2.11)**
Trade openness	0.048	0.082	0.071	0.039
	(1.89)*	(2.82)***	(2.51)**	(1.32)
Life expectancy	-0.036	0.131	0.019	0.114
	(0.42)	(0.99)	(0.13)	(0.81)
Inflation	0.007	-0.001	0.001	-0.001
	(1.60)	(0.17)	(0.20)	(0.23)
Tertiary education	0.047			
	(2.67)***			
Institution	2.260	1.970	2.289	3.104
	(1.90)*	(1.80)*	(2.16)**	(2.68)***
(Initial GDP)*penetration	**0.012**	**-0.010**		
	(1.42)	**(0.75)**		
Initial GDP	**-0.030**	**-0.054**		
	(1.94)*	**(2.46)****		
Africa*penetration			**-0.026**	**-0.013**
			(4.64)* **	**(2.13)****
Africa			**-0.002**	**-0.006**
			(0.27)	**(0.78)**
Constant	0.003	0.004	0.001	0.001
	(0.58)	(1.07)	(0.35)	(0.18)
R square	0.30-0.10-0.84	0.36-0.10-0.71	0.40-0.10-0.78	0.37-0.10-0.82
Observations	94	271	151	182

significant at 10%; ** significant at 5%; *** significant at 1% (i) indicates the bloc of variables included in competition equation; (ii) Indicates the bloc of variables included in performance equation; (iii) indicates the bloc of variables included in growth equation.

Table A7. Partial correlation on financial sector regressions sample

	GDP/capita	Financial Market struct	Finance Liberalization	Finance Regulation	crise	Zone Franc cfa	Spread	Credit to private sector	Live expectancy	Population growth	Population	Tertiary education	Trade openness	Inflation	Market size
GDP/capita	**1**														
Fin Market struct	**0.2142***	**1**													
Fin Liberalization	**0.1684***	**0.5022***	1												
Fin Regulation	**0.3321***	**0.4430***	0.6086*	1											
Crise	**-0.215***	**-0.0834***	0.0503	0.1279*	1										
Zcfa	**0.0394**	**-0.0710***	-0.0033	0.0672*	0.0518	1									
Spread	**-0.208***	**-0.0392**	**0.2478***	**0.2012***	**0.166***	**0.099***	**1**								
Credit to private	**0.3645***	**0.0889***	**0.0401**	**0.0796***	**-0.190***	**0.028**	**-0.351***	**1**							
Live expectancye	**0.5525***	**0.0302**	0.2259*	0.1454*	-0.106*	-0.104*	-0.168*	0.2535*	1						
Population growth	**-0.091***	**-0.0254**	-0.0752*	-0.0675*	-0.0458	0.125*	0.0122	-0.1289*	-0.0552	1					
Population	**-0.256***	**0.1233***	-0.1446*	0.0014	0.137*	-0.184*	-0.121*	-0.0334	-0.1045*	0.0006	1				
Terciary education	**0.6426***	**0.2430***	0.2075*	0.3803*	-0.0185	0.059	-0.105*	0.4005*	0.3881*	-0.0942*	0.070*	1			
Trade openness	**0.5311***	**-0.0790***	0.1759*	0.1986*	-0.114*	-0.0397	0.057	0.2737*	0.3770*	-0.0713*	-0.285*	0.3811*	1		
inflation	**-0.272***	**-0.0034**	-0.1180*	-0.0724*	0.146*	-0.373*	0.245*	-0.3478*	-0.1833*	0.043	0.196*	-0.1842*	-0.1238*	1	
Market size	**0.1988***	**0.3252***	-0.0547	0.1847*	0.0372	0.0326	-0.161*	0.1534*	-0.0329	0.0292	0.594*	0.4090*	-0.2688*	0.1469*	1

Table A8. Financial performances and market structure: OLS estimation

	(1)	(2)	(3)	(4)	(5)	(6)
	spread	**Credit**	**spread**	**credit**	**credit**	**spread**
GDP/capita	-0.094	0.302	-0.128	0.287	0.162	-0.142
	(1.32)	(2.80)***	(1.83)*	(2.45)**	(0.88)	(1.66)
Competition	**0.092**	**0.115**	**-0.060**	**0.044**	**-0.082**	**-0.067**
	(0.33)	**(0.46)**	**(0.24)**	**(0.18)**	**(0.28)**	**(0.34)**
Financial openness			**0.371**	**0.169**		
			(1.45)	**(0.62)**		
Interest rate instability	0.142		0.155			0.069
	(2.10)**		(2.22)**			(2.14)**
Zone CFA	3.986	5.995	2.708	5.414	6.024	5.656
	(1.15)	(1.21)	(0.83)	(1.06)	(1.34)	(1.41)
Financial Crise					-0.433	0.064
					(1.39)	(0.31)
Time	0.601	-0.021	0.475	-0.083	-0.049	0.526
	(3.59)***	(0.09)	(2.29)**	(0.31)	(0.19)	(3.54)***
Sadc	1.408	1.004	1.660	0.996	3.678	1.859
	(0.88)	(0.34)	(0.87)	(0.34)	(1.41)	(1.08)
Eca	-0.560	-4.290	-2.518	-4.969	-8.759	-3.271
	(0.24)	(0.69)	(0.82)	(0.82)	(1.18)	(1.08)
Sacu	-1.886	3.375	-0.263	4.081	6.270	4.266
	(0.62)	(0.53)	(0.07)	(0.64)	(0.79)	(1.43)
Cedeao	0.461	-2.417	0.959	-2.250	-4.489	-4.876
	(0.10)	(0.38)	(0.24)	(0.35)	(0.80)	(1.06)
Cemac	-3.137	-3.975	-2.302	-3.594	-2.816	-3.465
	(1.98)*	(1.60)	(0.99)	(1.28)	(1.26)	(1.97)*
Constant	0.875	0.350	0.416	0.163	2.111	2.124
	(0.68)	(0.30)	(0.31)	(0.13)	(1.04)	(1.74)*
Observations	63	69	63	69	49	44
R-squared	0.38	0.28	0.43	0.28	0.32	0.47

Robust t statistics in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

Table A9. Growth and finance performances: OLS estimation

	(1)	(2)	(3)	(4)
	GDP/capita	**GDP/capita**	**GDP/capita**	**GDP/capita**
Credit to private		**0.058**	**0.390**	
		(2.49)**	**(2.14)****	
Spread	**-0.299**		**-0.359**	
	(2.01)*		**(1.60)**	
Financial openness			**0.007**	
			(0.03)	
competition				**0.317**
				(1.11)
State intervention			0.291	
			(0.95)	
Lag of GDP/capita	0.342	0.320	0.404	0.236
	(2.57)**	(2.34)**	(2.02)*	(1.55)
Life expectancy	1.499	0.885	3.052	2.249
	(2.33)**	(1.44)	(2.87)***	(2.38)**
Pop growth	-17.228	-23.199	-20.541	-21.500
	(1.62)	(1.79)*	(1.39)	(2.07)**
Tertiary education	0.217	0.206	0.320	0.338
	(2.12)**	(2.36)**	(2.38)**	(2.62)**
Trade openness	0.218	0.423	-0.037	0.087
	(0.93)	(2.04)**	(0.10)	(0.30)
Inflation	0.105	-0.074	0.160	0.062
	(1.36)	(0.87)	(1.32)	(0.64)
institution	-0.003	0.031	0.384	0.416
	(0.01)	(0.15)	(1.22)	(1.44)
Market size	0.058	0.104	-0.373	-0.394
	(0.22)	(0.44)	(1.04)	(1.13)
Zone CFA	3.457	2.492	12.188	3.553
	(0.96)	(0.70)	(2.58)**	(0.87)
time	-0.110	-0.381	-0.194	-0.364
	(0.47)	(2.03)**	(0.56)	(1.65)
SADC	-2.748	-2.644	-3.086	-3.151
	(1.26)	(1.46)	(1.42)	(1.34)
ECA	7.306	7.540	8.935	5.879
	(0.79)	(0.89)	(0.94)	(0.70)
SACU	-2.293	-2.826	-2.990	1.188
	(0.24)	(0.30)	(0.31)	(0.13)
ECOWAS	-5.383	-4.615	-13.144	-9.745
	(1.27)	(1.05)	(3.74)***	(1.70)*
CEMAC	-0.129	0.114	-1.707	2.453
	(0.08)	(0.06)	(0.45)	(1.05)
Constant	-1.472	0.354	-17.927	-14.972
	(0.24)	(0.07)	(1.85)*	(1.83)*
Observations	61	67	50	53
R-squared	0.80	0.79	0.88	0.81

Robust t statistics in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

Table A10. Linearity in finance:3SLS estimation

	(1)	(2)
	3SLS	**3SLS**
(i)		
	structure	**Structure**
Credit **to private**	0.015	
	(0.21)	
Spread		-0.046
		(0.52)
Financial openness	0.294	0.259
	(2.02)**	(1.80)*
Openness*initialGDP	**0.004**	**0.006**
	(0.36)	**(0.67)**
Market size	0.080	0.068
	(1.81)*	(1.65)*
Time	0.092	0.133
	(0.85)	(1.05)
Sadc	1.573	1.569
	(1.13)	(1.13)
Eca	-3.004	-2.578
	(1.09)	(0.95)
Sacu	1.709	1.072
	(0.55)	(0.34)
Cedeao	1.929	1.999
	(0.68)	(0.74)
Cemac	-3.905	-4.303
	(1.90)*	(2.06)**
Zone CFA	1.634	2.177
	(0.64)	(0.87)
Constant	**2.987**	**3.073**
	(6.70)* **	**(8.17)*** **
(ii)		
	Credit to private sector	**Spread**
GDP/capita	0.821	-0.438
	(4.25)***	(2.90)***
Instability of interest	-0.380	0.230
	(3.98)***	(2.98)***
Competition	0.218	-0.300
	(0.69)	(1.16)
Competition*initialGDP	**-0.058**	**0.063**
	(1.72)*	**(2.40)** **
Time	0.216	0.676
	(1.00)	(4.04)***
Sadc	-2.756	2.043
	(0.99)	(0.94)
Eca	-2.040	4.272
	(0.37)	(0.99)
Sacu	4.369	-7.175
	(0.75)	(1.59)
Cedeao	0.005	-4.841
	(0.00)	(1.18)
Cemac	-4.685	-4.103
	(1.14)	(1.28)
Zone franc CFA	4.466	10.131
	(0.98)	(2.85)***
Constant	-1.457	2.726
	(0.94)	(2.16)**

continued (Table A.10)

	(1)	(2)
	3SLS	**3SLS**
(iii)	**GDP/capita**	**GDP/capita**
Credit **to private**	1.443	
	(1.64)*	
Spread		-1.877
		(5.11)***
Spread*initialGDP		**0.207**
		(3.75)* **
Credit*initialGDP	**-0.168**	
	(1.60)	
Initial	0.638	0.075
	(1.96)**	(0.89)
Life expectancy	1.546	1.938
	(1.55)	(2.28)**
Pop growth	-20.543	-8.631
	(1.57)	(0.84)
Trade openness	-0.104	0.015
	(0.44)	(0.08)
Tertiary education	0.394	0.265
	(2.52)**	(2.45)**
Inflation	0.188	0.269
	(1.42)	(2.72)***
Institution	0.058	-0.026
	(0.72)	(0.39)
Time	-0.331	0.299
	(1.60)	(1.20)
Sadc	-0.311	-0.095
	(0.12)	(0.04)
Eca	6.332	7.385
	(1.16)	(1.87)*
Sacu	-3.006	-6.349
	(0.48)	(1.39)
Cedeao	-10.200	-10.231
	(1.76)*	(2.31)**
Cemac	2.445	-0.940
	(0.64)	(0.32)
Zone Franc CFA	4.994	10.573
	(0.91)	(2.80)***
Constant	**-5.096**	**-1.287**
	(1.04)	**(0.33)**
Observations	50	50

significant at 10%; ** significant at 5%; *** significant at 1% (i) indicates the bloc of variables included in competition equation; (ii) Indicates the bloc of variables included in performance equation; (iii) indicates the bloc of variables included in growth equation.

Table A11. Literature survey

I. Telecommunications effects

➢ **Telecommunication performances**

author	year	countries	period	main dependent variables	main independent variables	method of analysis	results
Olivier Boylaud and Nicoletti	2000	23 OECD	1991-97	performance (productivity, quality and price)	regulation, market structure and country specificities in economic structure (proxied by the share of new entrants or by the number of competitors)	Panel estimation techniques	competition generally brings about productivity and quality improvements and reduces the price of all the telecommunications segments including the fixed telephony, the mobile telephony and international The prospect of competition (as proxied by the number of years remaining before liberalization) generally has a strong positive effect on the productivity and the quality of services and a strong negative effect on prices
Fink, Mattoo and Rathindran	2003	86 developing countries	1985 to 1999	performance (mainline penetration level of productivity)	combinations and sequences of introducing competition and privatization;	Panel estimation techniques	comprehensive program of reforms, integrating as well the competition component as the participation (private Vs state) component, and framed by an independent body of regulation, led to an increase of 8% of the number of telephone lines and to a rise of 21% of the level of productivity compared to the years when the reform was only partial or non-existent They also found that the sequence of reform matters: mainline penetration is lower if competition is introduced after privatization, rather than at the same time
Wallsten	1999	30 pays africains et latino-américains	1984-1997	sur plusieurs indicateurs de performance	la privatisation, de la concurrence et de la réglementation	panel	positive relationship between increased competition and sectoral performance (as measured by price reductions to consumers, phone line penetration or labor productivity). l'impact de la privatisation est mitigé
Sékou Falil Doumbouya	2004	39 Sub Saharan Africa	1985 to 1999	sectoral performances	alternatives reforms : privatization and the instauration of competition (increasing number operators)	Panel estimation techniques	Reforms aiming to transform historical operator in shareholders enterprises as well as those of privatizations are associated to a significant higher penetration of mainline. However, the instauration of competition in mobile segment lead to positive effect but which is non significant. More notable, the competition in fixed segment is associated with lower penetration.

Continued (Table A11)

- **Telecommunications and income growth**

author	year	countries	period	main dependent variables	main independent variables	method of analysis	results
Hardy	1980	15 developed and 45 developing nations	1960 to 1973,	GDP per capita	on lagged GDP per capita, **sectoral performances (** lagged telephones per capita, and the number of (lagged) radios)	using cross-section data	telephones per capita had a significant impact on GDP, while the spread of radios did not
Norton	1992	47 developed and developing countries	1957-1977	income output	**sectoral performances** (penetration)	cross-section data analysis	the Telecommunications penetration lowed transaction cost and increase income output, this by improving the capital market efficiency and the investments
Waverman, Meschi and Fuss	2005	low and middle-income countries		economic growth	mobile telephony	3SLS estimator	mobile telephony has a positive and significant impact on economic growth, which is twice as large in developing countries when compared to that in developed countries
Anusua Datta and Sumit Agarwal	2004	22 OECD countries	between 1980 and 1992	growth	Penetration	panel	found the evidence of strong contribution of penetration to growth
Madden and Savage	1998	27 CEE transitional economies	1990 - 1995	income growth	Penetration fixed telephone	Kormedi and Meguire (1985) using OLS	evidence of a two-way causation between telecom investment and economic growth.
Mattoo, Rathindran et Subramanian	2006	60 countries Including 37 developing countries	1990-1999	income growth	liberalization of telecommunications services	cross-section data analysis	They find evidence for significant influence of telecommunications service trade openness on long run growth performance

continued(Table A11)

- **Reverse causality analysis**

author	year	countries	period	main dependent variables	main independent variables	method of analysis	results
Röller and Waverman	2001	on OECD countries		simultantely telecommunications performances and growth	simultanitely telecommunications performances and growth	3SLS estimator	a strong two-way relationship between telecommunications infrastructure and productivity
Sridhar and Sridhar	2004	Developing countries sample (including those of Africa).	1990 - 2001	simultaneitely telecommunications performances and growth	simultaneity telecommunications performances and growth	3SLS estimator	a strong two-way relationship between telecommunications infrastructure and productivity
Farid Gasmi, paul Noumba and laura recuero Virto	2007	29 developing countries and 23 developed countries	1985 - 1999	Performance regulation (proxy by penetration)	Regulatory governance (political accountability)	GMM	Evidence of a relative weak effect of polical accountability on the performance of regulation in developed countries and a much more clear-cutting effect in the case of developing countries: higher political accountability yields higher regulatory performance

Source: Author construction

Continued (Table A11)

II. Financial sector							
	➢ **Impact on efficiency: Net interest margin (NIM)**						
author	**year**	**countries**	**period**	**main dependent variables**	**main independent variables**	**method of analysis**	**results**
Saunders and Schumacher	1997	banks information for six selected European countries and United state	from 1988 to 1995	the net interest margin (NIM) of banks, and pure spread	market structure (concentration)	step estimation model of Ho and Saunders (1981) accounting for the banks specific effects	They found that market structure and interest rate volatility were very significant determinant of spread rate, and therefore of NIM
Kalirajan, McGuire, Nguyen-Hong & Schuele	2000	27 economies (developped ans emerging countries)	from 1988 to 1995	the net interest margin (NIM) of banks and pure spread	non-prudantial restrictions on trade in banking services : services trade restrictions, including domestic and international components	step estimation model of Ho and Saunders (1981) accounting for the banks specific effects	The foreign trade restriction emerge as a significant determinant of spread and therefore of the NIM
Claessens, Demirgüç-Kunt and Huizinga	2001	bank-level data for 80 countries	1988-95	Banks performances (profitability and overhead expenses)	openness (the foreign share of bank ownership)	weighted least squares, with the weights being the inverse of the number of domestic banks in a country in a given year (include country and time-specific fixed effects)	increasing the foreign share of bank ownership makes domestic banks more competitive and more efficient reducing their profitability and overhead expenses
Barth et al.	2001	60 countries (24 OECD 14 Latin American, 12 from SSA, and 12 from Asia,)	1970-1999	(b) securities development (a) bank development (c) industrialc ompetition	1.bank regulatory restrictions 2. mixing banking and commerce and 3. state ownership of banks	simple correlations, and probit regressions	There is no reliable statistical relationship between and a) how well-developed the banking sector is, b) how well-developed securities markets and nonbank financial intermediaries are, or c) the degree of industrial competition.
	Impact on financial depth: Credit to private sector						
Clarke, Cull & Peria	2001	4,000 enterprises in 38 developing (including six African)	late 1990s	Access to credit (average share of investment financed through bank lending)	foreign bank presence and of financial competition (decreasing of concentration).	standard maximum likelihood estimation	foreign penetration in the banking sector raises the average share of investment financed through bank lending. In addition, the concentration tends to make access to such financing more difficult

continued(Table A11)

		➢ **Financial sector and income Growth**					
author	year	countries	period	main dependent variables	main independent variables	method of analysis	results
Goldsmith	1969	35, all groups	1860-1963	real GNP p.c.	Financial Development FIR (˜domestic credit/GNP)	Cross-country	rough correlation between financial development and growth
E. Gelbard, S. Pereira	1999	38 African countries	1987-97	Growth	composite financial development variable including various financial policy aspects	Cross-country	positive impact of financial sector on growth the best contributor to the growth emerge to be the level of financial liberalization, the institutional change and the financial products varieties
Mattoo, Rathindran et Subramanian	2006	60 countries Including 37 developing countries	1990-1999	income growth	the financial sector openness (based on the commitments of individual countries under the GATS and capital controls index of Dalaimi)	Cross-country	the financial sector openness influences long run growth performance
Demirguc-Kunt, Levine, and Min	1998	80 countries	1988 - 1995	economic growth	foreign banks	weighted least squares	cannot find any direct link between foreign banks and long-run economic growth.
Francois and Eschenbach	2002	130 (including many developing and transition countries)	1990-1999	growth GDP	Banking concentration/ the net interest margin (NIM) of banks	cross-country data base of 3SLS	(1) Services trade liberalization contributes to decrease the concentration of market structure, (2) which will reduce the market power and then contributes to the sectoral performances, (3) which in turn participate to a higher economic growth.
Bayraktar and Wang	2006	28 developing and developed countries (none of which is Africa)	1994-2003	growth rate of GDP per capita	asset share of foreign banks	GMM technique in dynamic panel	The asset share of foreign banks has a significant positive effect on the growth rate of GDP per capita. The first stage results show that a higher share of foreign banks lowers overhead costs and net interest margins of domestic banks, indicating higher efficiency. In the second stage, they show that a higher efficiency increases economic growth.

Source: Author construction

CHAPTER IV: IMPACT OF THE LIBERALISATION OF TRADE IN SERVICES ON POVERTY IN AFRICA: CASE OF TELECOMMUNICATIONS SERVICES IN CAMEROON

1 INTRODUCTION

In the last 80's, Cameroonian government has undertaken a set of reforms in the services sector, leading notably to the privatization and openness to competition of important services, such as telecommunications, electricity, transportations and finances. The last majors acts of this long process have been the submission in 2005 of a pre-commitment list of multilateral liberalization in the framework of GATS (General Agreements on trade in services) at WTO and the publication in 2006 of the privatization offers of the last two important publics companies, in transportation sector (Cameroon air lines: CAMAIR) and telecommunications sector (Cameroon Telecommunications CAMTEL).

Among sectors involved in liberalization process, telecommunications which has been partially liberalized with the entry of two private operators in mobile segment (between 1999 and 2001) is undeniably the sector showing the most spectacular transformation, notably with the increase of services varieties, the decrease of prices (Djiofack and Keck. 2006) and the amelioration of penetration; the number of telephone subscribers increasing from 200 000 in 2001 to 2 million in 2004, and 3 million in 2008.

If reforms aimed at boosting activity in particularly inefficient and dramatically unbalanced sectors, they were also a means to alleviate commitments of the State (facing an unsustainable debt burden) and are nowadays an entire part of global policy to reduce poverty. In fact, from the statute of an Intermediary income country in 1985, Cameroon is since 2000 ranked among Heavily Indebted Poor Countries (HIPC), with an external debt over 240% of exports in 2000 and the poverty incidence over 41% in 2001 (ECAM II report, 2001).

In a crucial moment where Cameroonian government is about to attribute a private license in fixed telephony segment and a third license in the mobile segment, the aim of this work is to assess, the impact of telecommunications liberalization on poverty using a combined macro-micro simulation model.

The telecommunications services trade liberalization can affect households, either directly through prices or employments, or indirectly via economic growth (Dollar and Kraay, 2001).

Even if the direct effect is not very intuitive since telecommunication is traditionally an urban activity in Africa, it seems however, potentially important due to the recent transformations which set the telecommunications as a mass consumption product. The indirect effect is more obvious because of the crucial role that telecommunications services play in the competitiveness and productivity of the economy (as a whole), as an important input in production activities and as an exchange facilitators (Konan et al, 2002).

Number of recent studies evidences the positive effect of services trade liberalization on household welfare (see Warren, 2000; Verikios et al, 2002; Hertel et al, 1999). However, only the study of Rutherford et al (2005) on Russia assessed the impact of services liberalization on poverty. The main innovation of their model is that they account for the foreign direct investment in business services and consider additional varieties of business services that endogenously increase the productivity of sectors using that service through the Dixit-Stiglitz variety effect.

This chapter follows the framework set in Rutherford et al (2005) and Konan et al (2006), by considering the imperfect competition in services sectors and modeling the productivity gain. However, three contributions have to be underlined:

First, instead of modeling productivity gain through the only variety effects, we model the overall productivity gains occurring from trade in services. This is done by introducing the level of penetration, as input of global productivity of factors (GPF). The penetration is based itself on the level of liberalization (number of operator). The two elasticities characterizing these relationships have been estimated in the chapter 2, using a model of simultaneous equations, estimating on the one hand, the effects of penetration on growth and on the other hand, the effects of liberalization on the penetration. Our approach allows capturing other sources of productivity gains than variety effects, which can be substantial in the case of trade in services[79].

Second, instead of modeling the market power (markup) through the Lener equilibrium (profit maximization), we adopt the Eastman-Stykolt (1960) approach (see Warren (2000) and Konan et al (2002)). In fact the former approach, developed in Rutherford et al (2005)

[79] These include notably the gain of rationalization, where trade shift production to more efficient firms within an industry and the technical progress that may induce firms to move down their average cost curves.

assumes a market structure characterized by the Chamberlain "monopolistic competition" before and after liberalization. Such approach relies on the assumption of free entry and exit of firms, which seem particularly inappropriate for telecommunications services, where liberalization always consisted either of the transformation of public capital into private capital, or of the introduction of competition by allowing limited licenses (Konan et al, 2006). The Eastman-Stykolt approach consists for producer, to impose a surplus (representing the markup rate) over the average cost. The markup has been estimated in an econometric model, allowing to determine the market power and its elasticity with respect to the service liberalization indicator (number of operators).

Third, contrary to the studies discussed above, we follow Verikios et al (2002) in assuming the non substitutability of domestic and imported services, for finances and telecommunications sectors. In fact, the domestic suppliers of these services do not directly compete with Foreign Service suppliers in cross-border trade. The cross-border telecommunication services, for instance, cannot be directly consumed by domestic users. They rather, constitute complementary services to domestic telecommunication operators to provide international telephone calls, which is the service that final users actually purchase.

Our results show that the liberalization is successful in reducing poverty. The attribution of a supplementary license in the mobile segment of telecommunications would lead to a decrease of poverty incidence by 2% on average. It appears, as in Rutherford et al (2005) and Konan et al (2006), that the main gain procured by services liberalization are generated by productivity effects, even if the markup effect remain positive.

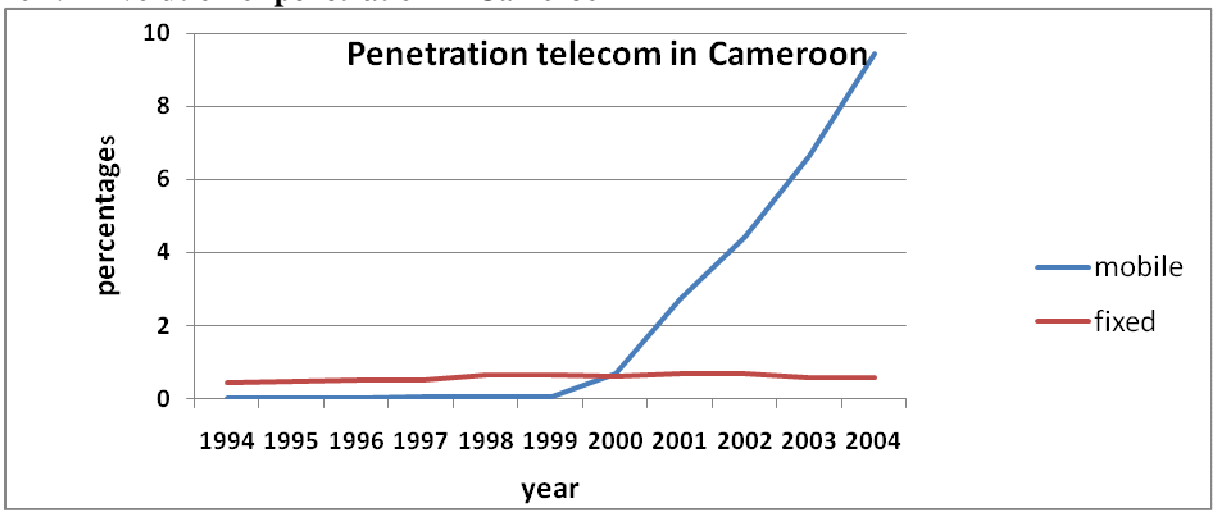
This chapter is organized as follows: the next section presents the place of telecommunication and the development of its trade policy in Cameroon. Section III proceeds to review of literature analyzing the poverty effects of liberalization of trade in services. Section IV presents the empirical model to analyze the effects of liberalization of trade in services. The model consists in two steps: first, we use the Cameroonian SAM (social accounting matrix) for 2001 to simulate in a Computable general equilibrium model (CGE) the impact of policy changes on macroeconomic indicators. The second step, relying on the database of households income survey for Cameroon in 2001 (ECAMII), use the output of CGE model to estimate the impact of policy changes at individual level. This step follows the accounting macro-micro simulation approach developed in Chen and Ravallion (2003). Section V

proceeds to the calibration of the model while, section VI presents the simulations scenarios and results. The last section provides the conclusions and main recommendations of the study.

2 Telecommunications activities and policies in Cameroon

Like in most of African countries, Cameroonian telecommunications sector has benefited from a spectacular development since the year 2000. The contribution of telecommunications to the added value has grown from 2% in 2001 to 3.5% in 2006. In its 2003 economic report, the BEAC (central bank of Cameroon) attributed more than 2% of Cameroonian growth in 2003 to the development of telecommunications services. The services of mobile telephony were the most dynamic (see BEAC, 2003). In fact, the number of subscribers to mobile telephony has been multiplied by 20 in just seven years, moving from 200000 in 2000 to 2 million in 2004 and 3 million in 2008. This represents a change in mobile penetration rate from less than 1% of population in year 2000, to 15% in 2004 (see figure 1).

Figure 1. Evolution of penetration in Cameroon



Source: author construction

The development of Internet services has also been substantial, despite the constraints related to access to computers and the mediocrity of the fixed telephone network. While the first Internet connection in the country is very recent (since 1997), there were more than 1 million Internet users in 2006, including 10000 subscribers [80]. This sector has a great potential for jobs both for highly skilled people and for young qualified medium people through Internet cafés (estimated at more than 400 in 2006) that offer a range of services including messaging, information searches , consultations databases, the Net phone, the webcam and other services.

[80] Figures are provided by the « Mission Economique française » in Yaoundé

With only 115000 subscribers in 2004, fixed telephony segment remains the weakest link in the chain of Cameroonian telecommunication and shows modest results despite 40 years of public monopoly on all segments of telecommunications (fixed, mobile, fax, telegram). On the eve of liberalization and the introduction of mobile telephony in 1997, the IMF painted a grim situation of fixed sector: only 0.5% of the population had access to telephone lines, only 43% lines installed were in service due to technical problems, the waiting list represented twice the number of lines connected, and the average waiting time to install a new line was five and a half years. This provision has not changed substantially although the competition of mobile segment. Thus, the fix penetration remained under 1% of population between 2001 and 2004 (see figure 1).

2.1 Evolution of the legal framework

Telecommunications were long considered in Cameroon as a public service area, separated from the commercial sphere. Thus the sector remained until 1998 a public monopoly, on the one hand provided by the International Telecommunication Company of Cameroon (INTELCAM), which was in charge of international telecommunications network, and on other hand by the Department of Telecommunications of the Ministry of Posts and Telecommunications, which had responsibility for the national network.

The diagnostic of deficiencies in public management (as noted above) and ambition to benefit from the development of new technology in the field of telecommunications at the international level have spurred a broad sector reform in the context of structural adjustment plans. The reform, brought by the law of July 1998, aimed primarily at liberalizing the sector through privatization of the public entity and the opening to competition. It also helped on the one hand to merge activities of international and domestic telecommunications within a new structure, CAMTEL, and on other hand to the establishment of a regulatory body, the Agency for Telecommunications Regulatory Board (ART) to ensure the proper functioning of the sector and competition among operators.

Although the company of fixed telephony, CAMTEL, has still not found a taker, liberalization has nevertheless allowed the entry of two private mobile phone companies: Mobile Telecom Cameroon (MTN), subsidiary of the South African of the same name (license obtained in

January 2000), and Cameroon Orange, a subsidiary of France Telecom / Orange (license obtained in June 1999).

While telephony field seems a little competitive with a public monopoly (CAMTEL company) on the network of fixed and duopoly on the Mobile Network (MTN and Orange companies), the opposite is true for the distribution segment of the Internet, which is very competitive with more than 400 Internet cafés mainly in the cities of Yaoundé and Douala (but rising sharply in other provincial cities).

However, the privatization of CAMTEL and the granting of a new license in mobile telephony announced by the government may improve competitiveness in the telephone market and above all improve national coverage. In 2008, the operators were covering only nearly 3 million subscribers (fixed and mobile) in a total potential estimated at 5 million in the mobile market alone[81].

Like in most African countries, the development of telecommunications policies in Cameroon traditionally takes place away from the sphere of multilateralism of GATS; international aspects of the regulations in the domestic telecommunications services (interconnection issues of standards, and Tariff) being discussed under an international advisory committees of the ITU or bilateral agreements between international service providers (Doumbouya, 2004). Thus, the country has not commitment in the framework of GATS to date. However, a "proposal of offer" (or pre-commitment) has been submitted at WTO in 2004, in the perspective of an agreement on Doha round negotiations.

Despite liberalization, the State is still very present in the area, maintaining a monopoly on fixed telephony and especially retaining the prerogative policy guidance and regulation of the sector, through the regulatory body (ART) on which he has total control.

3 Survey of literature estimating the impact of trade in services on poverty

[81] These figures are from the « Mission Economique française »

Our analysis relies on two domains of literature: the literature of trade in services liberalization modeling in CGE and the literature of impact analysis in poverty.

3.1 CGE and analysis of Trade services impact

The literature on trade in services liberalization can be differentiated by (i) the type of trade restriction considered; (ii) the number of countries considered; (iii) and the way to introduce the assumptions of imperfect competition into the CGE model.

As mentioned above, the GATS distinguish four modes of supply of services. For each mode, it distinguishes between two types of trade barriers: market access and national treatment. There are therefore eight types of protections possible for each service. However, most CGE models study liberalization of services, either through mode 1 (cross-border trade) or solely through the mode 3 (commercial presence: FDIs) or mode 4 (temporary movement of natural persons).

The pioneering study by Brown et al. (1996) adopts a multi-regional approach, which allows to account for the interaction among regions and countries. Based on the Michigan data base, these authors simulate the effects of a 25% reduction in ad valorem tariff equivalent of trade barriers on cross-border trade (mode1). They conclude that liberalization promotes trade for all countries. This approach, also used by Hertel (1999), focuses on cross-border trade and does not account for FDI in services (mode 3) which is one of the key vehicles by which services are traded internationally[82].

Dee and Hanslow (2000) addressed this shortcoming by assessing separately the cross-border trade (mode 1) and the investments flows mode (3) [83]. They also modeled the effects of product variety, expressing consumer welfare as a positive function of services varieties. Therefore, the global gains from removing barriers to trade in services come from four sources: improvements in the allocation of resources, increased returns to the world stock of

[82] Other studies focusing only on mode 1 are from Chadha (2000), Chadha et al. (2001), Benjamin et Diao (2000), The Australian Department of Foreign Affairs (1999) and Robinson et al. (1999)

[83] Other studies modelling the mode 3 are from Brown and Stern (2001), Konan and Maskus (2002), Tarr, Markusen (2002) and Jensen et al (2004 and 2005).

capital, increased product variety, and terms of trade variation. However, their models containing only three sectors, including a single aggregate service sector, are rather stylized.

Verikios and Zhang (2001) extend Dee and Hanslow (2000) model to focus on two individual sectors: telecommunications and financial services. Trade liberalizing in telecommunications is estimated to increase world GNP by 0.1 per cent (roughly $US 24 billion)[84].

Recent studies provide a more detailed model at the level of single countries to assess the impact of trade in services liberalization. The more representative are from Jensen et al, (2002, 2004), Rutherford et al (2005) based on Russia, and Konan et al (2006) based on Tunisia. Like Verikios and Zhang (2001), Rutherford et al (2005) modeled separately mode 1 and mode 3, and then introduce the gains of varieties. However, their variety gains following Dixit-Stiglitz is modeled through a production function, rather than consumer's welfare. The authors assumed that openness to FDIs in services sector increased the varieties of services, which in turn enhanced the productivity in sectors using business services as input. In the case of Russia, they find that the main gain is provided by the productivity effect allowed by the FDI liberalization. The mean welfare gain to Russia from its WTO accession, averaged over all households amounts to 7.3 percent of Russian consumption when the productivity effect is included, and would be only about 1.2 percent otherwise.

But this approach limits the productivity gains occurring from liberalization to the gain of variety, ignoring other productivity sources such as rationalization gains, where trade shift production to more efficient firms within an industry and the technical progress that may induce firms to move down their average cost curves. In this study, we try to account for the full productivity gain by estimating it from an econometric model. The model is explained in the next section.

Other limitation of Rutherford et al (2005) study is that their model adopted a pricing approach assuming the Chamberlain "monopolistic competition" before and after liberalization[85]. This approach relies on the assumption of free entry and exit of firms, which

[84] The above studies relying in multi-regional CGE have many inconvenient. The quality of data at worldwide could be doubtful, particularly for developing countries. In addition, the worldwide framework imposes the same assumptions to all countries in market structure (see Hertel, 1999).

[85] They model a situation where each company within an industry is supposed to offer a differentiated product from those of rivals, and where no company have enough power to be able to control the prices of others. In this

seem particularly inappropriate for telecommunications services, where liberalization always consisted either of the transformation of public capital into private capital, or of the introduction of competition by allowing limited licenses (Konan et al, 2006).[86]

Konan et al (2006) circumvent this limitation in the case of Tunisia and derived the Lener markup condition by considering alternative market structures (monopoly, oligopoly, cartel and monopolistic competition) in order to determine the impact of telecommunications liberalization under each market structure. The consideration of alternative market structures allows the authors to highlight the role of regulation on the impact of telecommunications liberalization in Tunisia. The Tunisia gain from the attribution of a supplementary license in telecommunication would be 0.65 per cent of welfare gain if there is a strong pro-competitive environment that permits the constitution of a Cournot duopoly. Otherwise, the two firms would collude (yielding to a cartel) and the economy would face a loss of 0.25 per cent of welfare. However, Konan et al's results suffer an important drawback, as the level of initial markup, which deeply influences the amplitude of effects in this kind of model (see Reimer 2002), is assumed subjectively. Our study corrects this shortcoming by estimating the markup through an econometric model.

Alongside the choice of an appropriate market structure, the maximization approach also suffers from the complexity of computing income elasticity for consumers and sectors using goods as an indicator of intermediate consumption. Therefore, many studies prefer a more practical approach known as Eastman-Stykolt (1960) (see Warren (2000) and Konan et al (2002)). It consists of imposing an extra price (markup) over the average cost. The surplus is determined outside the model. This margin may represent the difference between the domestic price and the international price of the service; it may also be estimated through econometric techniques, giving price elasticities over trade policy. This approach is the one used in the present study.

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context, firms characterized by increasing returns to scale will maximize their profits by equalizing the marginal revenue and the marginal income, while considering the assumption of zero profit

[86] The choice of monopolistic competition relies much more on ease of modeling than on its realism (see Krugman and Obstfield, 2003). Indeed, the assumption of zero profit exonerates from having to derive the elasticities, a necessity to determine the level of markup associated (under alternative market structure).

3.2 CGE and poverty: microsimulation studies

In the perspective of poverty analysis, the conventional Computable General Equilibrium (CGE) model is not sufficient. It only provides the income effect for the representative households group specified in the SAM. To circumvent this limitation, the CGE pioneering studies assumed a functional form of the distribution of revenue for each category of household specified in the model (see De Melo and Robinson (1982); De Janvry et al (1991); and Decaluwé et al (1999). The reliability of this approach, however, is based on the type of distribution function considered even though the literature does not relieve the indisputable selection criteria (see Reimer, 2002; Boccanfuso et al, 2003). Furthermore as highlighted by Cockburn (2001), regardless of the functional form used, this approach follows the assumption that the first time is fixed and not affected by the impact analyzed, an unrealistic assumption given the heterogeneity of households in terms of resource endowments and consumption habits.

Therefore, it is necessary to model directly the impact of a macroeconomic shock at individual household's level. This approach is called macro-micro simulation. The only study analyzing the impact of trade liberalization in services on poverty through the micro-simulation is that of Rutherford et al (2005) studying the impact of Russia's entry to WTO. Rather than considering the representative household groups as in the standard CGE models, the authors incorporate all 55,000 households from the Russian Household Budget Survey (HBS) as "real" households in the model. The poverty indicators are directly computed from the change in welfare of individual households observed in the CGE model. This approach of macro-micro simulation is say "integrated"[87].

The main limitation of integrated macro-micro simulation is the difficulty in the implementation, as stressed Boccanfuso and Savard (2006). The problem resides on the establishment of a correspondence between the aggregated accounts of the SAM and the

[87] An application of this method on Cameroon is provided by the study of Emini et al (2005), who estimated the impact of the potential agreements from the Doha negotiations on poverty. They used the 2001 Cameroonian SAM , to which they add the 52000 households of the ECAMII. Their result shows a positive contribution to poverty reduction of 1.5% on average. However, their study does not integrate any scenario on services liberalization. Other applications of integrated micro-simulation are provided by Annabi et al. (2005) based on Senegal and Cockburn et al (2004) on Nepal.

survey data at the level of individual households, but also on the numerical resolution of the model (see Chen and Ravallion 2003.).

A more practical approach of macro-micro simulation say "sequential" is provided by the study of Chen and Ravallion (2003) assessing the household welfare impacts of China's accession to WTO. It is a two-step analysis. As a first step, the GTAP (Global trade analysis program) model is used to estimate changes in the prices and wages due to WTO accession. Then the changes in prices and wages are passed on survey data from the 1999 Urban Household Survey (67900 households) and the 1999 Rural Household Survey (16900 households) to estimate corresponding changes in income and consumption[88]. Finally the FGT (Foster, Greer and Thorbecke) indexes are calculated at individual level to analyze poverty. This approach of macro-micro simulation say "accounting" has the disadvantage, however, of not taking household behavior at micro level into account. As highlighted by Cogneau, et al (2003), this approach assumes that the households do not respond to changes in the pricing system, and therefore considers that households' shares of factors are fixed and that only profitability could change. For the sake of simplification of the resolution, we choose in this study to follow the approach of Chen and Ravallion (2003). [89].

4 Model analyzing poverty impact of telecommunications liberalization in Cameroon

4.1 CGE module

Under the framework of trade in goods analysis, the modeling of a liberalization policy generally consists of increasing the prices of imported goods by the tariff to customs or the tariff equivalent of a non-tariff protection (See De Melo and Tarr, 1992 and Löfgren, 1999).

This approach based on the neo-classical framework (constant returns to scale and perfect competition) is inadequate for the analysis of trade in services, as highlighted by the following

[88] This approach excludes de facto any feedback effect of income distribution among households on the macroeconomic model (CGE).
[89] The only application to an African country is that of Boccanfuso and L. Savard (2006), which is based on Malian households' expenditure survey (2001) to study the impact of cotton subsidies on poverty.

facts. First, unlike trade in goods, which is essentially cross-border, the GATS distinguish four modes of supply for services[90]. In addition, trade restrictions on goods targeted primarily foreign producers, while barriers on trade in services could include both foreign and local firms. For each mode of service, there are two types of restrictions: barriers to market access which restrict the establishment and ongoing operations of all firms in a sector, and limitations on national treatment (discriminatory barrier) which hamper the establishment and ongoing operations of foreign firms in a sector. Finally, while the use of imperfect competition has always been an exception in the models of goods liberalization, it becomes the rule in the case of services because services production is characterized by low competitive structure while facing increasing economies of scale, especially in small economies.

These peculiarities of trade in services involved additional effects, compared to the classic liberalization of goods, which is explicitly modeled in this study. These include, on the one hand productivity gains related to the entry of FDIs, economies of scale and increased variety of services, and on the other hand, the pro-competitive gains arising from the decrease in prices as a result of competition.

The CGE model used in this analysis is based mainly on the structure and assumptions of standard CGE models (see De Melo and Tarr, 1992; Löfgren et al, 2001; and Decaluwé and Savard, 1999). Our main contribution to the model is based on the introduction of productivity effects and markup as explained in what follows.

The Productivity effect is captured in the CGE model by introducing the level of penetration, as input of global productivity of factors (GPF). The penetration is based itself on the level of liberalization, expressed here by the number of operators. The two elasticities characterizing these relationships have been estimated in the Chapter 2 using a model of simultaneous equations, estimating on the one hand, the effects of penetration on growth and on the other hand, the effects of liberalization on the penetration[91].

[90] The **mode 1** is the cross-border delivering, the **mode 2** is the consumption abroad, the **mode 3** is the commercial presence (FDI), and the **mode 4** is the presence of natural person. A detailed definition of the four modes is provided in introductive chapter o this thesis

[91] An extensive literature survey on the relationship between the GDP growth and the penetration has also been exposed in the chapter 2.

The Pro-competitive effects arise from the introduction of imperfect competition effect in the services sector. It will be modeled by assuming that consumer price is equal to the average cost plus a markup. The markup is ultimately modeled as a function of the level of liberalization. The level of markup and its elasticity with respect to the level of liberalization (number of operators) have been estimated in chapter 1, through a market power model.

While the first effect is modeled through the production function, the second is captured via the pricing equation.

4.1.1 Production technology:

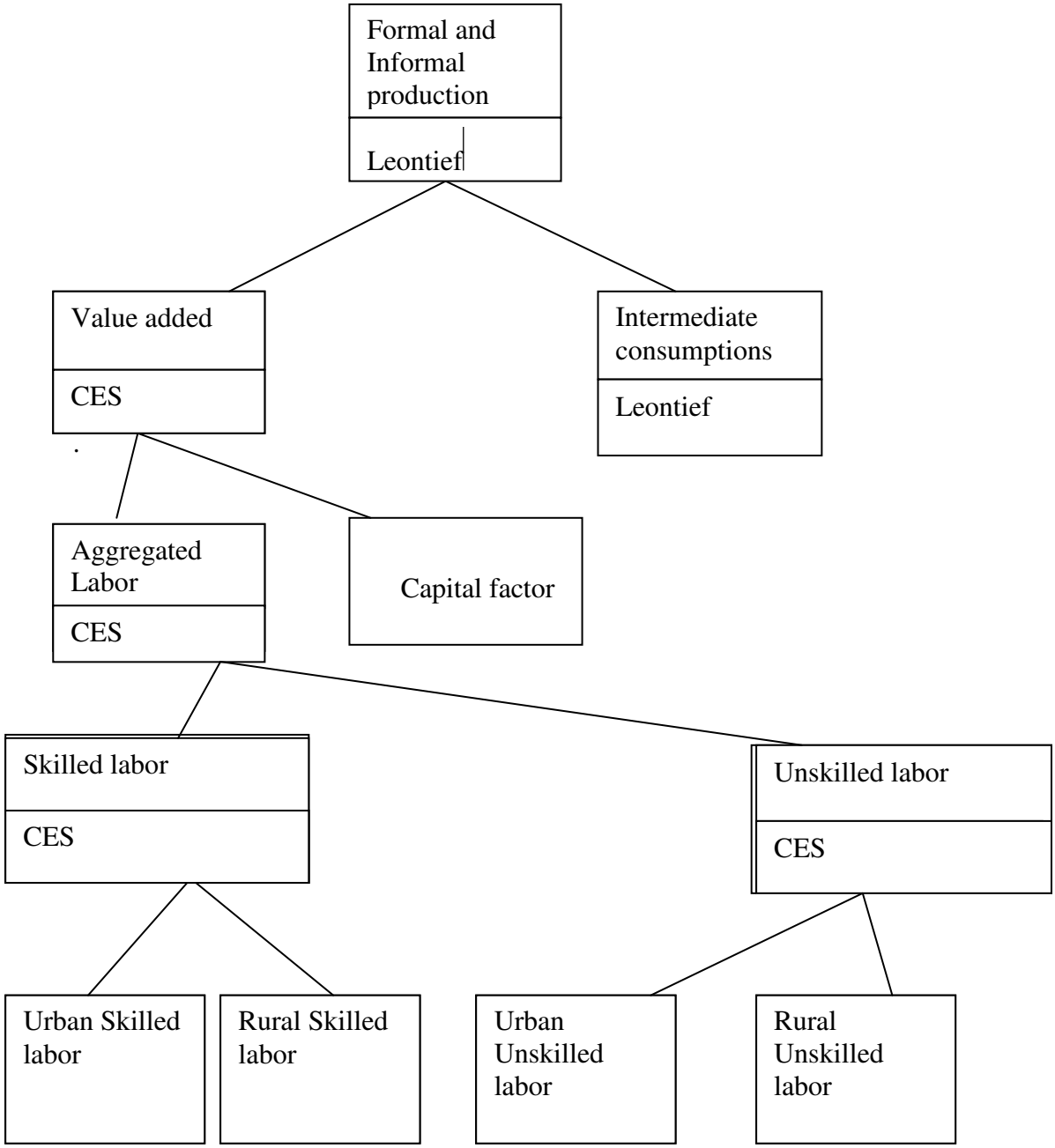
The model covers an economy with 7 branches. All sectors have a branch in formal and informal sectors except telecommunications and finance, which have only the formal component[92].

All sectors, except those of the telecommunications and finances, are assumed to produce produced under conditions of constants returns to scale and perfect competition, implying that prices equal marginal cost of output. The telecommunications and finances are characterized by increasing returns to scale and imperfect competition. Although we have no study that shows the formal existence of economies of scale in these areas, this hypothesis considered in almost every study modeling the impact of trade in services (see. Jensen et al, 2004 and Konan et al, 2006) seems particularly appropriate given the low size of Cameroonian market. The producers maximize their profits by minimizing their cost under the constraint of a multi-level production function, whose structure is given in Figure.2 below.

At the first step, the production function, in each sub-sector (formal and informal), is a combination (fixed coefficients, or "Leontief function") of added value and intermediate consumption. Then, the added value is approximated with Constant elasticity Function (CES), using the capital and the aggregated labor. The aggregated labor is approximated with a CES technology, using skilled and unskilled workers. At the last stage, the demand for skilled labor or unskilled labor is operated by arbitrating between rural and urban workers with a CES function. The model distinguishes therefore 8 segments of labor.

[92] The absence of decomposition in telecommunications and finances sectors is only motivated by the absence of information concerning the shares of informal activities within these sectors.

Figure 2. Multi-level production function



Source: Author construction

4.1.2 Mathematical formalization

- **Production function**

For all sectors, production QA_a is defined as follow:

$$QA_a = \frac{QVA_a}{\mu_a} \qquad a \in A \tag{23}$$

$$QCI_a = \theta_a \,.QA_a \qquad a \in A \tag{24}$$

Where: (A) is the set of activities branches

μ_a and θ_a are constants indicating the Leontief coefficients relating the production to the added value and aggregate intermediate consumptions respectively.

QCI_a is the aggregate intermediate consumption of activity (a) and is defined as a Leontief function of disaggregated inputs (QCI_{ca}). Thus QCI_{ca}, is formulated as follows:

$$QCI_{ca} = ci_{ca}.QCI_a \qquad c \in C, \quad a \in A \tag{25}$$

Where: (C) is the set of traded product from the activities from A. as all products in this model is traded, (C) is equal to (A).

ci_{ca} is the technique coefficient, representing the share of intermediate consumption from (C) in the production of (A).

- **Added value**

The value added is a CES function combining the global capital (KT) and global labor (LT). We also integrate the quality of services (QS_a) in order to model the productivity effect. The value added is then given by:

$$QVA_a = \left[QS_a.B_a\right]\left[\delta_a K_a^{\rho a} + (1-\delta_a)\, LT_a^{\rho a}\right]^{1/\rho a} \tag{26}$$

Where: $\rho_a = \frac{1-\tau_a}{\tau_a}$ with $\tau_a > 0$, the constant elasticity of substitution.

δ_a is the share of capital in total added value.

B_a is the exogenous component of the global productivity of factors of the branch (a).

QS_a represents the supplementary productive efficiency of the activity (a) generated by the liberalization of services. It is defined as the level of telecommunications services accessibility (IS) raised to the power of the elasticity of GDP growth with respect to the penetration (γ). The formulation is as follow:

$$QS_a = IS^{(\gamma)} \qquad a \in A \tag{27}$$

IS in turn is a function of the number of operators (N). They are linked by an elasticity determined in the structural model in chapter 2. It is defined as follows:

$$IS = \beta . N^{ELASTacces} \tag{28}$$

Where, β indicates a constant, and $ELASTacces$, the elasticity of penetration with respect to the number of operator.

4.1.3 Imperfect competition and price setting: pro-competitive effect

The CGE literature does not relieve on any unanimous method of modeling the behavior of firms in imperfect competition with increasing returns to scale. The main difference resides on the choice of the rule of pricing in perfect competition to replace the marginal cost pricing rule (used in perfect competition). Numerous studies adopted the profit-maximizing approach, allowing expressing the Lener relationship as follow:

$$\frac{P_v - Cm_v}{P_v} = \frac{\Omega_v}{N\varepsilon_v} \tag{29}$$

Ω_v is the conjecture with respect to the change in industry output. Its represents the change in industry output as the result of the change of one unit in output of the variety (v).

ε_v is the elasticity of demand.

N is the number of firms.

P_v is the price of a variety (v)

Cm_v indicates the marginal cost

$$P_v = Cm_v \frac{1}{\left(1 - \frac{\Omega_v}{N\varepsilon_v}\right)} \tag{30}$$

$$P_v = Cm_v \left[1 + \left(\frac{1}{\left(1 - \frac{\Omega_v}{N\varepsilon_v}\right)} - 1\right)\right] \tag{31}$$

$$P_v = Cm_v (1 + r_v) \tag{32}$$

$$P_v = (r_v + 1) Cm_v \tag{33}$$

r_V is equal to zero in the case of perfect competition.

We define $r_v = \left(\frac{1}{\left(1 - \frac{\Omega_v}{N\varepsilon_v}\right)} - 1\right)$ as the percentage markup of price over marginal cost.

This expression rise additional issues about the determination of the conjectures and the elasticity of demand: Firstly, the selection of the conjecture is arbitrary[93]; secondly this approach suffers from the complexity of computing the demand elasticity (ε_v) for consumers and sectors using the good as intermediate consumption.

We have avoided these issues by estimating the markup (r_v) through an econometric model in chapter 1. This is on line with the so-call "Eastman-Stykolt (1960) approach"[94]. However, in opposite of the studies following this approach (see Warren (2000) and Konan et al (2002)), we consider the markup (r_v) in our model as an endogenous variable. Relying on the

[93] See De Melo and Tar (1992) for a comprehensive analysis of alternatives assumptions about the conjecture.
[94] It consists to impose an extra price (markup) over the average cost. The surplus is determined outside the model. This margin may represent the difference between the domestic price and the international price of the service, or be estimated through econometric techniques.

elasticity determined in the econometric model, we express the markup as a linear function of the number of operators (N). The formulation is given below:

$$\frac{r - r_0}{r_0} = -ELAST.\left(\frac{N - N_0}{N_0}\right) \quad (34)$$

Where r_0 indicates the initial markup.

In our model, the simulation of the liberalization will consist in changing the number of operators (N).

ELAST is the elasticity of markup with respect to the number of operators.

4.1.4 Other equations of the model

After defining the two effects of liberalization, we will introduce them in a general equilibrium model, considering successively the factor market, the foreign market and major macro-economic closures. The equations in the following paragraphs are common to all standard CGE models.

4.1.4.1 Factors' market

The factors' markets are supposed to be in perfect competition. For each segment, the labor is supposed mobile between the different sectors of production, which involves a uniform salary across all sectors. The wage is flexible to allow equality between the supply and demand of labor in each segment.

The capital factor is fixed for each sector, and its remuneration is specific for each sector.

4.1.4.2 External trade

For all sectors of goods and services, other than the telecommunications and finances, the allocation of domestic consumption follows the Armington (1969) approach assuming an imperfect substitutability between domestic goods and those imported (through a constant elasticity of substitution (CES) function).

Aggregated domestic output is allocated between exports and domestic sales on the assumption that suppliers maximize sales revenue for any given aggregate output level, subject to imperfect transformability between exports and domestic sales, expressed by a constant-elasticity-of-transformation (CET) function.

For finances and telecommunications, we assume the non substitutability of domestic and imported services, as the domestic suppliers of these services do not directly compete with foreign services suppliers in cross-border trade. This assumption is developed in Verikios et al (2002), who point to the fact that the cross-border telecommunication services, for instance, cannot be directly consumed by domestic users. They rather, constitute complementary services to domestic telecommunication services to provide international telephone calls, which is the service that final users actually purchase. The equations of external trade are presented in annex IV from equation (A22) to (A26).

4.1.4.3 Households incomes, savings and consumption

Households receive incomes and transfers from other institutions, including the profits made by companies in which they control a share of the capital. The transfers from the rest of the world are fixed in foreign currency. Households use their earnings for direct taxes, consumption, savings and transfers to other institutions. The direct tax and the share of savings are constant shares of household income.

The consumption of product (c) by a household (h), CM_{hc}, is determined by the utility function of linear expenditures system (LES) of Stone and Geary (1954). This function allows expressing the consumption of a given product in two components: incompressible consumptions and discretionary consumption. Its formula is given by:

$$CM_{hc}.PQ_c = PQ_c.\pi_{hc} + \chi^m_{hc}\left(CM_h - \sum_{c'}\pi_{hc'}.PQ_{c'}\right) \quad h \in H;\ \ c \in C \qquad (35)$$

Where: π_{hc} is the share of subsistence consumption of product (c) by the household (h).

χ^m_{hc} is the marginal share of consumption of product (c) by the household (h). PQ_c is the composite price of the product (c).

The product $PQ_c.\pi_{hc}$ represents the incompressible consumption of the product (c) for the household (h). The equations related to households incomes, savings and consumption are presented in annex IV from equation (A34) to (A38).

4.1.4.4 Macroeconomic and closures relations

In the standard CGE model, the macroeconomic closures describe how equilibrium is achieved in the balances for the government, the rest of the world, and the savings-investment account. We consider three standard closures: saving-investments balance, fixed current account balance and the government balance.

For the government balance, the closure is that government consumptions and all tax rates are fixed. This implies that government savings is a flexible.

For the savings-investment balance, we assume a savings-driven closure: this implies that all nongovernment institutions (households and firms) savings rates are fixed, whereas the investment is flexible so as to assure that the investment cost will be equal to the savings value.

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For the external balance, the closure is that the real exchange rate is flexible, while foreign savings (the current account deficit) is fixed. In fact to maintain the current account constant, while maintaining the international price fixed, the real exchange rate variation adjusts the domestic prices, so as to generate appropriate change in volumes of imports and exports.

The equations describing the macroeconomic equilibriums and closures are presented in annex IV from equation (A41) to (A46).

4.2 Poverty module

Poverty status in a given society characterizes the situation of households or individuals who are unable to acquire a living standard equivalent to a minimum acceptable by the society norms, called poverty line.

The literature distinguishes monetary poverty (or material) and non-monetary poverty. The latter is linked to aspects of social deprivation such as social exclusion or political rights

abuse. Without underestimating the non-monetary component, we will deal in this work with the monetary aspect of poverty, which is more accessible to the economic analysis (notably due to data availability). The welfare indicator widely used in this context is household expenditure. It is generally perceived by the consumption of private and public, the income only being used as a proxy for consumption (Lachaud, 2000).

4.2.1 Measurement of poverty

To measure poverty, we opt for the indexes proposed by Foster, Greer and Thorbecke, (1984) said FGT index. It is expressed as the sum of individual differences between the poverty line and the income of those below it raised to the power of the degree of sensitivity (α), then this sum is expressed as a fraction of poverty line itself.

$$P_{\alpha}^{h} = \frac{1}{n_h} \sum_{m_h} \left(\frac{SP - YM_h}{SP} \right)^{\alpha} \tag{36}$$

Where: m_h is the number of people from the category of households (h), below the poverty line

n_h is the total number of individuals in the category of households (h)

YM_h is the income of a household from category (h).

SP is the poverty line ;

α is the coefficient of sensitivity or aversion to poverty (α >0) ;

P_{α}^{h} is the FGT index corresponding to the class of poverty aversion (α) ,for the households from the category (h)

For $\alpha = 0$, P_{α}^{h} represents the index of poverty incidence (or poverty rate). Its primary utility is counting people, which are located under a poverty line.

For $\alpha = 1$, P_{α}^{h} represents the index of poverty depth, and estimate the average gap between the poor and the poverty line.

for $\alpha = 2$, P_{α}^{h} represents the severity of poverty. It takes into account both the distance to the poverty line and the degree of inequality among the poor

4.2.2 Poverty line

The choice of the poverty line is crucial to determine the level of poverty indexes. We rely in this study on the official poverty line of Cameroon, estimated at 255000FCFA. However, we will assume that this threshold is endogenous and depends on the general trend of consumer prices[95].

So $SP = \overline{SP}_O.(1+\Delta(IPC))$ (37)

4.2.3 Sequential macro-micro simulation

As noted above, our micro module is a reduced form of macro-micro simulation presented in Chen and Ravallion (2003). called "accounting micro simulation". Unlike the most advanced sequential micro simulation (see Robillard and Bourguignon, 2004), the accounting approach does not endogenize the allocation of factors, or the consumer at the micro level. Only prices and wages are expected to vary depending on the output of the CGE model. The impact on the welfare of a given household is then measured by a simple accounting relation, expressing the difference between income, earned from its offer of factors (labor and capital), and its expenditures.

$$g^h = \sum_c \left(w_c LS_c^h \right) \Delta w_c + \sum_c \left(r_c K_c^h \right) \Delta r_c - \sum_c \left(PD_c QD_c^h \right) \Delta PD_c \quad (38)$$

Where: h indicates the households and c the product of consumption.

LS_c^h, K_c^h and QD_c^h indicate, the labor supply, the supply of capital and the consumption of household h of a product (c), respectively.

Δw_c, Δr_c and ΔPD_c indicate the percentage of variation in wages, return on capital and the price, Respectively

The post-simulation poverty indicators are computed by adding the change in the welfare (g^h) of the previous formula to the initial income of households.

[95] This definition has the disadvantage of confusing the evolution of prices in the official minimum basket, to the general price level (global basket).

5 Calibration and simulations results

This section presents the data and parameters used in our CGE model.

5.1 Presentation of the social accounting matrix (SAM)

The SAM used in this study represents the Cameroonian economy of 2000/2001 fiscal year. It is adapted from a SAM built by a World Bank team and Emini (2004). The authors used the input output matrix of Cameroon for fiscal year 2000/2001 and the Cameroonian households' survey of 2001 (ECAMII). To adapt this original SAM to our analysis, we have made some changes, using the Cameroonian household survey of 2001 (ECAMII). The main changes are described as follow:

- The initial 42 branches were aggregated into 8 new branches; 6 out to 8 branches were further divided into informal and formal sub-branches[96].
- Using the households' survey, the two original categories of labors (skilled and unskilled) in the original SAM were separated according to geography (urban and rural) and status of the activity (formal and informal) criteria.
- The rebalancing of the matrix was made by the entropy method, developed in Robinson et al (2000). This consisted of solving a program minimizing the sum of the squares of the differences between the new values and the former values of the SAM (LSO principle), under the constraints of balancing between the expenditures and the resources. The final SAM is presented in annex II; Table.AII-3.

5.2 Household database and consistency with the CGE model sectors

[96] The separation of the branches into formal and informal sub-branches has been operated from the original SAM following the next steps: (1) To share factors remunerations between formal and informal components, the Cameroonian input-output matrix of 2001 provides for each of the 42 initial branches, the distinction between the formal activities' value added and informal activities;(2) In addition The DSF ("déclarations statistiques et fiscales") give exactly the payroll for each formal sub-branch, which allows to determine the shares of labor and capital in the formal sub-branch; (3) The corresponding shares in the informal sub-branch are determined according to that obtained in the formal sub-branch. To do this, we follow the Cameroon's accounting system which assumes that the share of the remuneration of labor in the informal sector equals that in the corresponding formal, increased by 50% of the share of capital in formal value added. This increase of 50% is subjective, and attempts to take into consideration the fact that informal activities are more labor-intensive compared to the formal activities (see Emini, 2004).

The SAM and the households' survey database used in this study have many convergence points, as the former has been build on the basis of the latter. This link is indispensable to translate the variation in price and wages of the CGE model to individual households. TableAII-4 and Table AII-5 in annex II, show the correspondence between the 8 sectors of the SAM and the 37 sectors of the ECAM II in production and expenditures sides respectively.

5.2.1 Treatment of households income

To introduce the wage effect into the households' database, there is clearly a need that each individual in ECAM II declared his income. However, ECAM II Database provides exact information on income for only 41% of workers surveyed. The remaining workers surveyed are people who have either reported incomes in a given interval (56%), or declared a wage equal to zero (3%).

To determine the initial wage for the whole sample, the following procedure has been opted: (i) individuals who reported not to be working in ECAM II (54% of the population) have no benefited from any change in their income. Their incomes are set to zero; (ii) for those who declared working (46%), their initial income is estimated through econometric techniques. This consists in a first step of estimating a model of wage relying on the sample of individuals who have correctly declared their income (i.e. declaration of precise figures). The model estimation, in turn, has been used to predict the income of people who have not declared their income correctly (i.e. those who declare revenue in a given interval, or the figure zero). By concerns of consistency between our micro module and the SAM, we estimate the workers revenues by replicating the same method (Heckman model) and specifications (same controls variables) used by the World Bank team and Emini (2004) to build wages in the original SAM[97]. The TableAII-1 in Annex II shows the results of estimations that allow the prediction of workers revenues.

5.2.2 Adjustment of ECAMII data to those of the SAM

There is a major source of inconsistency between the SAM and the base ECAM II, related to the fact that the amounts of totals revenue and expenditure in the SAM 2001 have been

[97] A brief description of this approach is provided in the box 1 in annex II.

collected from macroeconomic sources (TEE, 2001), whereas the source is micro data for ECAMII.

We proceed to a readjustment in order to allow each source of welfare (salary, capital and consumptions) in households' database to have the same total as in the SAM. The new values at individual level are obtained by correcting each variable of interest (salary, capital and consumptions), proportionally to its initial level (i.e. value declared).

$$VAL^{a}_{ECAM,h} = \left(\frac{VAL^{0}_{ECAM,h}}{\sum_{h=1}^{10992} VAL^{0}_{ECAM,h}} \right) \times VALTOT_{SAM} \qquad (39)$$

Where, $VAL^{0}_{ECAM,h}$, indicates the value declared by the respondent in the ECAMII database. It refers to the wages, capital or consumption of a household.

$VAL^{a}_{ECAM,h}$, indicates the value after adjustment; and

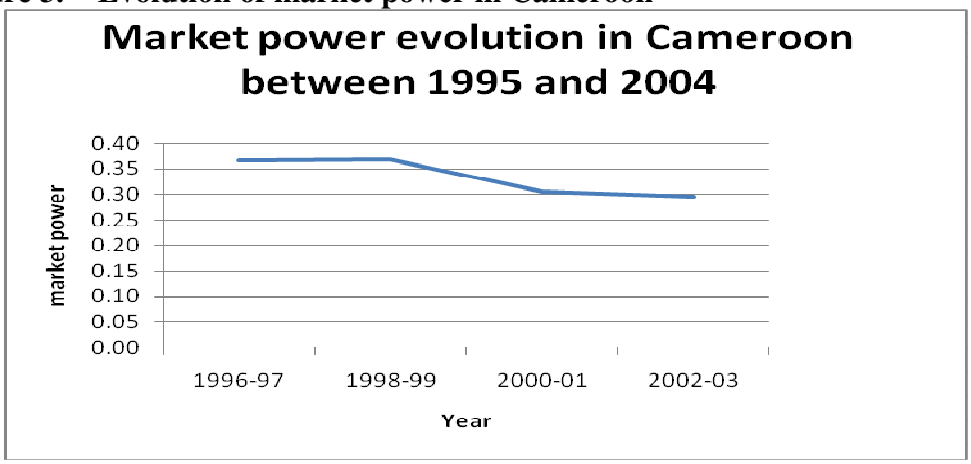
$VALTOT_{SAM}$ indicates the total amount for the variable in the SAM. For example in the case of wages, this value indicates the total payroll in the SAM.

5.3 Estimation of the CGE model parameters

5.3.1 Determination of the markup level, and its elasticity with respect to the number of firms

As mentioned above, the markup amplitude, r , and markup elasticity, $ELAST$, with respect to the number of firms is determined in Chapter I using a model of market power.

Figure 3. Evolution of market power in Cameroon



Source: Author's construction

Using the estimates of chapter I, the figure 3 provide the prediction of the Cameroonian market power from the 1996 to 2003. In 2001, the size of initial market power predicted in Cameroon is $r_0 = 30\%$ of telecommunications producer price.

Concerning of market power with respect to the number of operator, its value is $ELAST = 0.15$.

5.3.2 Determination of parameters related to the productivity effect: indicator of telecommunications access and its elasticity with respect to growth.

The productivity effect is based on three parameters:

- IS , the level of telecommunications services access (penetration), provided by the ITU database which stands at about $IS = 4\%$ for 2001.
- $ELASTacces$, the elasticity of penetration with respect to the number of operators which is estimated in the structural model of chapter II determining simultaneously the growth and penetration. Its value is $ELASTacces = 1.2$. A 1% change in the number of operators leads to the improvement of 1.2% in the level of penetration of telecommunications in our model.
- γ, the elasticity of production with respect to the penetration. It is also estimated in the structural model of chapter II, determining simultaneously the growth and penetration. Its value is $\gamma = 0.12$.

5.3.3 Elasticities of behavior functions

- **Income elasticity for the consumption function**

Income elasticities are estimated econometrically using data of successive Cameroonian input- output matrix from 1994 to 2005.[98]. The results are reported in the table 1. Giving the low number of observations used in the regression (only 15), a sensitivity analysis would be made on the values of these parameters while interpreting our results.

[98] The regression is performed for each of the 42 sectors constituting the original SAM. The dependant variable is the logarithmic of consumption and the independent variable is the log of household income (allocated to the total consumption).

Table 1. Income elasticity

Sectors	**Income Elasticity**
Other business Services	0.78
Food Agriculture	0.23
Agriculture of exportations	0.4
Industry	1.51
Publics and social services	0.43
Transportations	0.78
Telecommunications	1.18
Finances	1.29

Source: author's estimation

- **Elasticities of production and trade behavior**

The elasticities of CES functions of value added, the allocation of labor, the allocation of consumption and CET allocation function of local production are provided by the study of Devarajan and Rodrik (1989) in Cameroon. However, we need to perform a sensitivity analysis on these parameters.

6 Simulations and results

This section present results, their interpretations and discuss about their validity (thought the consideration of alternatives model assumptions, parameters and closures)

6.1 Specification of scenarios

We examine the potential impact of the increase in number of telecommunications operators in Cameroon. All simulations are based on the scenario of the attribution of one license for a mobile telecommunications operator. This constitutes the policy more likely to be followed by the Cameroonian government in the next step of telecommunications reforms.

Since liberalization is modeled through the productivity and mark-up effects, our simulations are built to distinguish the main gains occurring from each of these channels:

- the central scenario includes the both productivity and markup effects, and relies on the regulation policy of an archetype African country.
- the second simulation performs the liberalization effect only through the markup effect.
- the third simulation assumes the absence of a pro-competitive regulation, and therefore a total collusion among the operators. Hence the liberalization effect is reduced to the productivity effect.
- An important parameter of our model is the elasticity of market power (markup) in respect to the number of operator. It represents the extent of the sensitivity of market power to the liberalization in a given market. The value of elasticity (-0.15) used in the first three scenarios presented above, has been determined in an econometric estimation based on a sample of African countries, representing therefore the situation of an archetype African country. In order to examine the role of a strong pro-competitive regulation on liberalization effects, we consider in the fourth scenario elasticity equal to -100%. This represents the best pro-competitive policy allowing the total cancelling of market power (markup). The both productivity and markup effects are considered in this scenario.

Our analysis will focus on the first simulation, before making the comparison with others. Moreover, before presenting the poverty impact, we focus first on the macroeconomic and sectoral effects, particularly on variables used as input in the household module of our model.

6.2 Macro economics results

Macroeconomics variables considered here are households' revenue and others including: government and firms' revenue, investment and GDP.

6.2.1 Households' revenue

The table.2 below, presents the macroeconomic effects resulting from liberalization of telecommunications for all scenarios. The first scenario (see Simulation 1) reveals an increase of household's revenue of around 3.2%. This increase is attributable to a combination of

rising in wages and the return on capital, in all sectors[99]. As far as others simulations are concerned, the simulation 2 (see Simulation 2) and 3 (see Simulation 3) also show the increase in households revenue of 0.22% and 3.01%, respectively. It appears therefore that the main gain for households occur from the productivity effect captured in the third scenario, the markup channel showing relatively slight effect.

Table 2. Macroeconomic indicators

		Productivity +Markup	**Markup**	**Productivity**	**Productivity +Markup with strong regulation**
Indicators	Baseline	Simulation 1	Simulation 2	Simulation 3	Simulation 4
Household income	5241688.79	3.21	0.22	3.01	4.03
Enterprise saving	560380.00	3.51	-0.15	3.67	2.65
Government saving	243372.00	22.45	-0.36	22.82	20.40
Enterprise revenue	1946772.00	3.51	-0.15	3.67	2.65
Government revenue	1509982.00	3.62	-0.06	3.68	3.29
IPC	1.03	0.12	-0.06	0.18	-0.15
GDP	6349348.10	3.02	0.00	3.02	2.90
Investments	1110701.00	7.69	-0.14	7.84	6.86
RECETTE	528146.00	3.77	-0.04	3.81	3.56

Source: Author's construction

Considering now the simulation 4 (see Simulation 4), which represents the situation where the liberalization is accomplished beside a strong pro-competitive regulation (elasticity of markup equal to -100%), i.e. policy allowing a full competition (with the cancellation of the all markup): the gain of households would change slightly from 3.21% (first scenario) to 4.03%. This result seems to suggest that, there is a very low potential gain to be expected from a pro-competitive effect. However, the implications of this result should be relativized, as the pro-competitive effect is unambiguously underestimated in our model, due to the very low level of telecommunication weight in the consumer's expenses in 2001 (the reference year of our analysis). The boom of telecommunication which took place since that date, has moved the telecommunication from a luscious product (190.000 consumers in 2000), to a product of mass consumptions nowadays (3 million of consumers in 2008)[100]. The introduction of a new

[99] The factors remunerations will be analyzed below.

[100] The computation of a new CPI combining the consumptions prices of our model with the expenditures weighting of the Cameroonian input-output matrix of 2005, gives a result which is five time more important than that our model (-0.3% against -0.06% in this model).

telecommunication operator, leading the price reduction in the current context, would therefore have a higher impact than in our model

6.2.2 Others macroeconomic indicators

The Table 2 above, also reports the evolution of government and firms revenues, as well as investment and GDP for all scenarios. For the scenario 1, it appears that the increase in productivity generates a GDP growth of 3.02%. This engenders government and firms' income grows in the same way as those of households. This increase in income is reflected in government and firms' savings, which increase up to 22.45% and 3.51% respectively, leading to a raise in investments by nearly 8%.

When observing other simulations, it appears that the change in GDP induced by the markup effect is zero (simulation 2). Indeed, under the assumption of the fixity of factors supply (labor and capital), a change of GDP growth in our model can only be the result of a change in productivity.

6.3 Sectoral effect

In this section we analyze some interesting sectoral variables, in view of the following poverty analysis. Four variables are considered here: production, market prices, wages, and rental rate of capital. The last three variables constitute the key variables affecting households' welfare.

6.3.1 Production effects

Table 3 below presents the changes in production resulting from the liberalization of telecommunications for all our scenarios.

The first scenario shows that liberalization contributes to an increase in production for all sectors. This increase ranges from 2.8% in food and agriculture sector to 5.04% in

telecommunications sector. As underlined before, the change in production is the result of two factors: the productivity effect (see Simulation 3) and the markup effect (see Simulation 2).

Table 3. Production effect

		productivity +markup	**markup**	**productivity**	**productivity +markup with strong regulator**
Sectors	Baseline**.**	**Simulation 1**	**Simulation 2**	**Simulation 3**	**Simulation 4**
Other business Services	3139768.00	4.14	0.00	4.14	4.12
Food Agriculture	2934049.00	2.82	-0.04	2.86	2.63
Agriculture of exportations	463327.00	3.63	-0.03	3.66	3.45
Industry	3915240.00	3.45	-0.03	3.48	3.29
Publics and social services	906059.00	2.90	-0.04	2.63	2.38
Transportations	572331.00	2.92	0.07	2.85	3.27
Telecommunications	103020.09	5.04	1.81	3.21	15.17
Finances	114205.58	4.73	0.07	4.65	5.03

Source: Author's construction

The markup effect (Simulation 2) is the result of the decrease in telecommunication price. It encourages the demand for telecommunications and the production of goods and services using them intensively as inputs. It is the case for finance, transportations and social services. Moreover, given that the labor supply is fixed in the model, the supplementary labor needed for this change in production is provided by others sectors which could experience a fall in their production. This is the case for food agriculture. However, except the telecommunication sector, the markup effect on production is not significant for any other sectors, as it ranges from -0.04% in food Agriculture to 0.07% in financial sector (change in telecommunication is 1.8%).

The change in production is therefore mainly occurring from productivity effect (Simulation 3), which allows a better production with the same amount of inputs. In fact, the productivity effect is introduced uniformly in all sectors of our model, through the efficiency coefficient of the production function. The difference in magnitude of its effects among sectors is therefore due to the second round effect. This can happen notably through the increase in final demand, resulting from the raise in household's revenue, which is determined by the income elasticity of each good or service. Hence finance and other business services that have the most important production effects turn out to be the sectors with the most important income elasticity. On the contrary, the food agriculture sector that has the least important elasticity in our model is also the sector where the output grows the least.

Concerning the fourth simulation (where the markup effect is maximum), the main observation is the important change in telecommunications production compared to other sectors. In fact, the production of others sectors remains relatively stable compared to simulation 1. This confirms the lack of influence of change in telecommunications price (markup effect) on the whole economy. The main reason is the relatively low size of this sector in Cameroonian economy in 2001, where it represented only 2.9% of the GDP. Therefore, the main telecommunications effects on economy rely on the qualitative effect (increase of productivity) rather than on price effect.

6.3.2 Prices effect

In Table.4 below, we present the changes in consumer prices index and price trends in each sector for the four simulations. In the central scenario (Simulation 1), liberalization leads to an overall increase in prices, consumer price index rising by 0.12%. If the markup effect (simulation 2) contributes to a decrease by 0.08%, the productivity effect rather contributes to an increase by 0.19%.

Table 4. Final consumptions price effect[101]

		Productivity +Markup	**Markup**	**Productivity**	**productivity +markup with strong regulator**
Sectors	Baseline	**Simulation 1**	**Simulation 2.**	**Simulation 3**	**Simulation 4**
Other business Services	1.01	0.36	-0.01	0.37	0.33
Food Agriculture	1.01	0.13	0.02	0.12	0.21
Agriculture of exportations	1.01	0.55	-0.02	0.57	0.43
Industry	1.06	0.26	0.01	0.26	0.30
Publics and social services	1.01	-0.04	0.04	-0.09	0.22
Transportations	1.06	-0.03	-0.01	-0.03	-0.03
Telecommunications	1.44	-3.01	-2.95	-0.05	-16.52
Finances	1.14	-0.03	-0.14	0.11	-0.63
IPC	1.03	0.12	-0.08	0.19	-0.15

Source: author's construction

[101] theTable AI-1 in annex I presents, the final consumptions prices besides the Investments and intermediates consumptions.

At the sectoral level, price effects are mixed. The results in the Table 4 show for the first scenario that the price has increased in four out of eight sectors. In fact, two opposite movements influence the evolution of prices in our model. First, the increase in final demand and investment, outlined above, which contribute to the increase in price. Secondly, the lowering of input prices caused by the lower prices of telecommunications, which contributes to the decline in prices. It is therefore consistent to notice that the results for the first scenario point to the decline in prices for sectors consuming intensively telecommunications (financial services, transportation and social services) and the increase for others (industry, food agriculture and agriculture of exportations).

6.3.3 Wages and capital return

The wages and return on capital are key inputs for the household module of our model. In fact, the CGE model assumes a neoclassical closure of the labor market where labor supply is fixed for each of the eight segments considered. Similarly, as the model is in comparative static, it is assumed that capital is fixed within each sector, with the variation in return allowing adjustments. Hence, household's income is mainly determined by the return on capital and wages, which in turn follows the evolution of production.

Table 5 below, shows the evolution of the remuneration of factors in each sector and for all of our simulations.

The scenario 1 (Simulation 1) points to increase of wages and returns of capital in all sectors. This trend is consistent since the prices of factors are increasing functions of production. Thus regarding the capital factor, the sectors which have seen their production increased the most are also those with the best raise in return on capital. This is the case for telecommunications services, finances, and other business services.

As far as the wages are concerned, the labor segments in which wages are growing the most are those used intensively in the sectors growing the most. Thus, the formal sectors (telecommunications, business services and finance), where production has increased the

most, explained the highest change in wage observed in formal labor segments (whether the location or the qualification considered)[102].

Table 5. Factors' remunerations

			Productivity +Markup	Markup	Productivity	Productivity +Markup with strong regulator
Factors		Baseline.	**Simulation 1**	**Simulation 2.**	**Simulation 3**	**Simulation 4**
	Other business Services	4.00	4.45	0.10	4.34	4.95
	Food Agriculture	4.00	3.11	0.04	3.06	3.31
	Agriculture of exportations	4.00	3.98	0.03	3.95	4.08
	Industry	4.00	3.67	0.02	3.65	3.76
	Publics and social services	4.00	2.90	0.12	2.78	3.52
	Transportations	4.00	3.06	0.18	2.88	3.97
	Telecommunications	4.00	6.24	3.19	3.00	23.72
Formal capital	Finances	4.00	4.19	0.19	3.99	5.14
	Other business Services	3.00	4.30	0.05	4.25	4.53
	Food Agriculture	3.00	3.22	0.02	3.20	3.27
	Agriculture of exportations	3.00	3.90	0.02	3.89	3.94
	Industry	3.00	3.67	0.02	3.65	3.74
	Publics and social services	3.00	2.98	0.09	2.89	3.43
	Transportations	3.00	3.17	0.13	3.03	3.86
	Telecommunications	3.00	0.00	0.00	0.00	0.00
Informal capital	Finances	3.00	0.00	0.00	0.00	0.00
	Rural not qualified formal	1.80	3.62	0.15	3.37	4.41
	Rural qualified formal	1.83	3.51	0.15	3.35	4.30
	Urban not qualified formal	2.35	3.62	0.15	3.47	4.41
Formal labor	Urban qualified formal	3.16	3.67	0.15	3.63	4.30
	Rural not qualified informal	0.50	2.07	0.03	2.63	2.81
	Rural qualified informal	1.25	3.07	0.03	3.02	3.81
	urban not qualified informal	1.50	2.67	0.03	2.63	2.81
Informal labor	Urban qualified informal	2.50	3.51	0.03	3.35	3.81

Source: author's construction

6.4 Poverty effect

We consider successively the analysis at national and individuals' level.

6.4.1 Poverty effect at national level

This sub-section performs the poverty impact analysis at the national level and on population sub-groups by comparing the results of the four simulations. The impact analysis on poverty

[102] Finance and telecommunication's services branches are assumed to be exclusively formal in this study.

is based on the household survey of ECAM II. It covers 10952 households and 54821 individuals representative of Cameroonian's total population.

As underlined in introduction, in 2001, 41% of the population lived below the poverty line in Cameroon. However, the situation of poverty in Cameroon is characterized by several disparities, related notably to education level and residential area. While more than 50% of the non-educated are poor, only 13% of people with upper secondary education and 6.2% of those who have tertiary education share the same fate. In rural areas, the incidence of poverty is 52% (representing 84% of the total poor in the country). The figure in urban areas is only 18%. Poverty in Cameroon is also linked to the status of the activity. Thus the incidence of poor is 25% among those who practice an activity in the formal sector, whereas it represents 54% in the informal activity.

Table 6 below gives the poverty impact of telecommunications' liberalization at the national level. Poverty impact is analyzed through the indicators, FGT-0, FGT-1 and FGT-2, describing the indexes of FGT (Foster, Greer and Thorbecke (1984)) when α takes the values 0, 1 and 2, respectively.

Regarding the incidence of poverty, FGT-0, scenario 1 shows that liberalization has contributed to a decline of 1.76% in poverty at national level. This decline is essentially due to the productivity effect (Simulation 3) which generates a decline of 1.72% of poverty. The markup effect (Simulation 2) has not showed a significant change (0.06%). However, it should be noted that liberalization accompanied by strong pro-competitive regulation, that would allow the total cancellation of markup (simulation 4), generates a supplementary point of decline in poverty, the total decline in poverty incidence moving from 1.76% in first scenario to 2.83%. [103]

It is also interesting to analyze poverty depth and severity, which generally grant more importance to the poorest. In term of poverty depth (FGT-1), the effect of liberalization is more important than the incidence as far as the scenario 1 is concerned; FGT-1 index declining by nearly 5.6% nationally. Similarly, in terms of severity, the impact of liberalization is more important, compared to the indicator of incidence; FGT-2 index

[103] As underlined above, the gains related to markup are underestimated in this model, given the low level of telecommunications penetration at the beginning of our period of study (2000).

decreasing by 6.5%. These results suggest that liberalization allows a decrease of the gap between the poor's incomes and the poverty line, as well as a decline in inequality among the poor.

Table 6. Poverty effect at national level

Indicators	Status	Productivity +Markup	Markup	Productivity	Productivity +Markup with strong regulator
		Simulation 1	Simulation 2	Simulation 3	Simulation 4
FGT-0	Baseline	0.41	0.41	0.41	0.41
	Change	1.76	0.06	1.72	2.83
FGT-1	Baseline	0.13	0.13	0.13	0.13
	Change	5.62	0.23	5.46	6.38
FGT-2	Baseline	0.06	0.06	0.06	0.06
	Change	6.50	0.17	6.17	7.33

Source: author's construction

6.4.2 Poverty by category of households

Given the distribution of poverty sets described in the previous paragraph, our analysis is based on the following 10 categories of households (distinguished by the criteria of qualification, location and level of activity): urban unskilled in formal sector, rural qualified in formal sector, urban qualified in formal sector, rural non qualified in formal sector, urban unskilled in informal, rural qualifies in informal sector, urban qualifies in informal, rural non qualifies in informal sector, rural inactive and urban inactive.

Table 7 presents the effects of the central scenario (simulation 1) on poverty incidence for each category of households[104]. As above, poverty is measured by the variations of FGT indexes, for $\alpha = 0$, 1 and 2 respectively. In the baseline scenario reported in column (1), the incidence of poverty (FGT-0) indicates that the poorest category is that of rural unskilled and occupied in the informal sector, with a poverty rate of 60%, while the richest category is the urban skilled engaged in the formal sector with a poverty rate of only 7%.

Column (2), which reports the poverty incidence effect of liberalization, reveals that all households groups experience a decrease in poverty. However, the magnitude of this effect is

[104] The Table AI-2 in annex I presents the results for the three others scenarios.

differentiated for the specific categories of households because of their heterogeneous factors endowment, the structure of their expenditures, and the differentiated initial level of poverty between households groups.

Hence, the group gaining the most in terms of poverty incidence is urban unskilled labor operating in the informal sector, which benefits from a decrease of 2.9 point in poverty. This decrease can be explained by the fact that products benefiting the most from lower prices are those consumed more intensively in urban areas (telecommunications services finance and utilities). Furthermore this category of households has the highest initial poverty rate among urban groups.

Table 7. Poverty indicator per households category(central scenario only)

		Households categories	FGT-0		FGT-1		FGT-2	
		(0)	(1)	(2)	(3)	(4)	(5)	(6)
Simulation 1			Baseline	Change	Baseline	Change	Baseline	Change
	Formal	Rural not qualified formal	0.40	2.63	0.16	5.00	0.08	5.25
		Urban not qualified formal	0.28	1.89	0.08	10.25	0.03	12.67
		rural qualified formal	0.22	1.74	0.06	6.83	0.02	8.50
		Urban qualified formal	0.07	1.48	0.01	19.00	0.00	0.05
	Informal	Rural not qualified informal	0.60	2.07	0.20	5.35	0.09	6.67
		Urban not qualified informal	0.37	2.92	0.10	12.40	0.04	16.00
		rural qualified informal	0.51	1.35	0.17	3.76	0.08	4.63
		Urban qualified informal	0.17	1.96	0.04	13.00	0.01	20.00
	Inactive	Rural inactive	0.51	1.95	0.17	2.94	0.08	3.25
		Urban inactive	0.21	0.07	0.05	4.60	0.02	5.00

Source: Author's calculation

Except the group of inactive, the group gaining the least in terms of the poverty incidence is the rural qualified and occupied in informal sector. This gain is justified by the fact that the prices of factors in the informal segments have progressed less than those in the formal segments (see Table 5 on factor remunerations).

Generally, it might be expected that the formal groups benefit the most in term of poverty decline - as wages in formal factors have increased the most -, and that the products whose price declined the most are those intensively consumed by households working in formal sectors (telecommunications finance and social services). This is the case for households in rural areas, where for equivalent qualifications, households benefiting the most from liberalization are those whose activities are in the formal sector. However, the opposite pattern is observed in urban households; for equivalent qualifications, the groups of households benefiting the most from liberalization are those whose activities are in the informal sector. This result is explained, at least partly by the fact that informal households have an initial level of poverty higher than households from the formal sector.

The analysis of poverty depth should be more informative as it is more sensitive than the poverty incidence (Boccanfuso and Savard, 2006). The depth of poverty (FGT-1), reported in Column 4 confirms the downward trend observed in incidence, but reveals more disparity in the amplitudes throughout household groups. Hence it clearly appears that urban groups are those benefiting the most; for the same qualification and the same status of activity (formal or informal), the groups residing in urban area have better gains in terms of reduced poor's income gap with the poverty line. This result suggests that the poorest people in urban areas benefit more from liberalization than their counterparts in rural areas.

The index of poverty severity (Column 6) reveals exactly the same trend as the depth. All the effects are positive and urban households enjoy better gains than their rural counterparts. This result suggests that beyond the decline in the average income gap with the poverty line, telecommunications liberalization contribute to reduce inequality among the poor, in each of the ten categories of households considered. However, the groups of urban households seem to benefit the most from this trend compared to rural households.

6.5 Results and discussion

To test the validity of our results, we consider now alternatives model assumptions, parameters and macroeconomics closures.

6.5.1 Alternative model: modelling the productivity effect through the pro-variety effect of telecommunications

One of the main limitations of our model is related to the uniform introduction of productivity effect in the different sectors. If this does not affect our results on average, as the elasticities used are those estimated on the economy on average, it could dissimulate the distribution effects of liberalization. As underlined above, the recent literature modeling the impact of trade in services has used to proxy the productivity gain, by pro-variety effects (Jensen et al, (2002, 2004) and Rutherford et al (2005)). If this approach ignore others components of productivity gains, its main advantage compared to the model developed above is that productivity gains are introduced in the sectors with respect to the weight of

telecommunications in the total intermediate consumptions of the considered sector. The approach therefore takes better consideration of the distributive effect of telecommunications liberalization.

As a robustness test of the distributive effect of our model, we perform our central scenario using the pro-variety effect as a proxy of productivity effects[105]. Following the recent literature (Jensen et al, (2002, 2004), Rutherford et al (2005)), we consider the effects of varieties relying on the Dixit- Stiglitz's model. This model assumes that the firms in the services sector to be liberalized produce differentiated services, and that, consumers and other sectors using these services have a preference for products variety. The main changes in the model remain on two points: first, the production function of the services branch is a constant elasticity of substitution (CES) function of different varieties:

$$Y_{az} = \left(\sum_{v=1}^{N} z_v^{\varphi} \right)^{\frac{1}{\varphi}} \qquad (40)$$

Where z_v indicates the production of the variety v.

As for the other sectors, the production function of a service variety is approximated by a Leontief function of total value added and composite intermediate consumption.

The elasticity of substitution between each variety is $\sigma = \frac{1}{1-\varphi}$

As the second change in the model, the services producing differentiated varieties are assumed to impact positively the production function of sectors using them as intermediate good. This is modeled by assuming that telecommunications is an imperfect substitute to value added in the sector using them as input:

$$\left[QVATOT_a \right] = \left[\theta_a QVA_a^{\lambda_a} + (1-\theta_a) Y_{za}^{\lambda_a} \right]^{1/\lambda_a} \qquad (41)$$

Where: QVA_a is the ordinary added value (function of labor and capital)

[105] This assumption is relevant to a large extent in the case of Cameroon where liberalization has been characterized by an impressive increase of services varieties. The table AII-2 in annex II shows the evolution of new telecommunications products in Cameroonian market between 1999, the year of the first liberalization, and 2007. During this period, the two liberalized segments, internet and mobile telephone, have benefited from the introduction of 16 and 14 new services or technology innovations respectively. The fixed segment, still under the public monopoly, has only benefited from one major technological innovation with the introduction of CDMA technology in 2005.

$QVATOT_a$ is the new added value,

θ_a is the share of telecommunications in the new added value

$\varepsilon_a = \frac{1}{1-\lambda_a}$ is the constant elasticity of substitution between the added value and the producer services (telecommunications).

Table AI-3 in annex I presents the macroeconomic impact of liberalization. Under our first scenario, including the productivity and the markup effect, the results point to an increase of 0.67% in households' income. This result is close to the 0.79 % of Konan et al (2006) who used the same approach in the case of Tunisia. However, this result represent an important gap with the outcome of the main model (including all productivity effects), as it represents less than the half of its impact (1.4%). The importance of this gap has no consequence for our macroeconomic finding in main model, as the variety effect is only a part of the productivity effect captured in our model.

More interesting is the impact of this distribution effect throughout our ten households' categories. Table 8 below presents the results of the poverty effect for each households group. On average the poverty incidence decrease by 0.55%. The decline in the incidence of poverty (Column 2) ranks from 0 to 0.86% and the changes in FGT-1 (Column 4) and FGT-2 (Column 6) are all positives. This is a support to our previous finding, that all of the households groups are to be benefiting from the liberalization, whatever the poverty indicator considered.

Table 8. Poverty indicator per households category (central scenario only)

	Households categories	**FGT-0**		**FGT-1**		**FGT-2**	
		Reference	**change**	**Reference**	**change**	**Reference**	**change**
	(0)	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Formal	Rural not qualified formal	0.40	0.38	0.163	1.15	0.082	1.19
	Urban not qualified formal	0.28	0.00	0.076	1.96	0.028	2.74
	rural qualified formal	0.22	0.09	0.060	1.83	0.023	1.76
	Urban qualified formal	0.07	0.39	0.012	4.89	0.003	4.41
Informal	Rural not qualified informal	0.60	0.51	0.203	1.68	0.090	2.22
	Urban not qualified informal	0.37	0.85	0.102	3.97	0.041	5.11
	rural qualified informal	0.51	0.86	0.167	1.37	0.075	1.75
	Urban qualified informal	0.17	0.86	0.035	5.07	0.012	6.03
Inactive	Rural inactive	0.51	0.63	0.170	1.24	0.077	1.51
	Urban inactive	0.21	0.03	0.053	1.88	0.021	2.06
Total	**Total**	**0.41**	**0.55**	**0.131**	**1.81**	**0.057**	**2.25**

Source: Author calculation

6.5.2 Macroeconomic and factors closures rule[106]

The results of CGE simulations are dependent to the parameters values and to macroeconomic and factors closures rules.

Table 9 below presents the effects of the central scenario (i.e. productivity and markup effect), on macroeconomic indicators for alternatives macroeconomic closures[107].

This chapter adopted the neoclassic closure approach which supposes endogenous investments. This implies that investment is adjusted endogenously to be equal to the sum of savings of all economic institutions (households, firms, government and the rest of the world). But this assumption is not always realistic in developing countries, where the objectives of investments are more likely to be fixed by government (Decaluwe et al, 2001), instead of being determined by the market.

Thus we will consider as alternative a so-call "Johanson economy" that assumes fixed investments. This implies that savings of domestic institutions adjust endogenously to balance the exogenous investments. Two cases are considered here: (i) the adjustment is operated through government savings, implying that the government consumption become flexible to allow the necessary adjustment of government savings (see Table.9 Column 2)[108]; (ii) the adjustment is operated through foreign aid, implying that foreign savings adjust endogenously to balance the exogenous investments (Column 3). The latter case is more relevant to the Cameroonian context, where the government massively receives international aid under the HIPIC initiative.

[106] Decaluwe et al (2001), and Harris and Robinson (2002) offer a complete overview of macroeconomic closures for a CGE model.
[107] The Table AI-4 in annex I, presents the results for others indicators including prices and wages.
[108]This closure would allow accounting for a potential important channel of liberalization effect transmission to poor. In fact the government could use the supplementary resources generated by liberalization to undertake pro-poor policy. However, the actual effect of such resources on poverty is quite complex. It depends entirely on the willingness and ability of the state to conduct a genuine policy for the poor, and to compensate losers of the liberalization policy including victims of the removal of subsidies for employment and consumption. However, in the African context, where states have severe fiscal constraints and where the power of civil society remains very low (non-independent unions), it is feared that additional resources generated by the liberalization would not be systematically used in the direction most favorable to the poor.

As far as labor market is concerned, the neoclassic closure assumes that labor supply is fixed, implying that wages adjust endogenously to allow the equality between the demand and the exogenous offer of labor in each segment. We will consider as alternative a more realistic economy with unemployment, where there is no restriction on labor supply (Column 4).

Concerning the capital, the model assumes a fixed and specific capital for each sector. We consider as alternative a flexible and unrestricted capital in the economy (Column 5).

Finally, many authors have pointed out the sensitivity of CGE model to the choice of numeraire (Hoffmann, 1999; Löfgren, 1999). The numeraire in the main model is exchange rate; we consider as alternative the consumer price index (Column 6).

Table 9. Closures rule sensitivity

	Baseline	**Current Account endogenous and investment exogenous**	**Government Consumption endogenous and government saving exogenous**	**Labor supply endogenous and wage exogenous**	**Capital endogenous and capital price exogenous**	**IPC exogenous and TCN endogenous**
	(1)	(2)	(3)	(4)	(5)	(6)
Government consumption	660749	0.0	8.7	0.0	0.0	0.0
Household income	5237311	3.3	3.3	5.8	9.1	3.2
Current account	-23037	213.5	0.0	0.0	0.0	0.0
CPI	1	-1.5	0.4	-0.7	1.7	0.0
GDP	6345194	3.4	3.4	6.2	10.1	3.4

Source : Author's construction

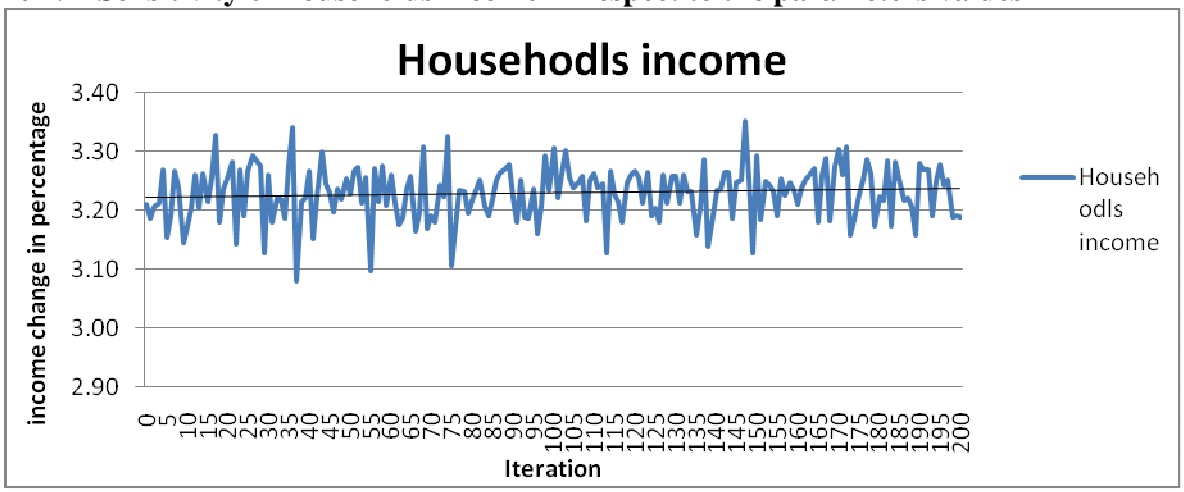
Two observations emerge from the results of sensitivity simulations. First, the closures considering the fixation of the number of quantity of factors (closure2, closure3 and closure6) produces quite the same amplitude of gains as the reference scenario (closure1), in terms of households' incomes, as well as in terms of GDP growth.

As the second observation, the scenario allowing the flexibility of factors supply produce, as expected significantly more important output in terms of household income and GDP change; the more profitable scenario being the one allowing the flexibility of the stock of capital. The two observations suggest that our results, which rely on fixed supply closures are globally stable and constitute the low bound effects result.

6.5.3 Sensitivity to the parameters

The behavior functions parameters (production and trade functions) used in this chapter have been adopted from the CGE model of Devaradjan for Cameroon in 1988, instead of relying on econometric estimates. We suppose here alternatives values for each parameter of trade and production functions in the interval [0.01, 4], which is the interval of parameters estimated in GTAP model (See Koffi et al 2005). Using the Monte Carlo approach, we have introduced 200 random sets of parameters in the model in order to simulate our central scenario[109]. The results of simulations performed for 200 set of parameters, are presented in the following Figure focusing on the value of households income.

Figure 4. Sensitivity of households income in respect to the parameters values



Source: Author construction

It appears from Figure 4 that the values of households' income are concentrated in the interval [3.08 to 3.35%] with an average to 3.22%. This output strongly supports the high stability of our results with respect to the behavioral parameters.

[109] This implies a random choice of: (1) 4*(200*8) values for production function of informal sectors; (2) +3*(200*6) parameters values for production function of formal sector; (3) +(200*7) parameters values for imports functions ; (4) +(200*7) parameters values for exports functions

7 Conclusion

This study's aim was to analyze the impact of telecommunications liberalization on poverty in Cameroon, using the macro-micro simulation approach, linking the output of CGE model simulations to household database, in order to compute poverty indicators. Our CGE model, build on imperfect competition assumptions, considers two channels of liberalization effects: the productivity effect and the markup effect. The two effects are introduced in the CGE model using elasticities estimated in the econometric analyses of chapter 1 and 2 respectively. The micro module of the analysis use the Cameroonian households income survey data of 2001 (ECAM II), and is based on the accounting micro simulation approach developed in Chen and Ravallion (2003).

Our results show that liberalization contributes to reduce poverty in Cameroon. The attribution of a supplementary license in the mobile segment of telecommunications would lead to a decrease of poverty incidence by 1.76% on average. It appears, as in Rutherford et al (2005) and Konan et al (2006), that the main gain procured by services liberalization are generated by productivity effects, even if the markup effect remain positive.

Our study suffers from some limitations: first our basis of analysis is the social accounting matrix of 2001. This period has the advantage to be the starting point of the liberalization process, then offering a credible counterfactual. However given the important increase in the number of telecommunications users since 2001 (200.000 compared to 3 million in 2008), it is obvious that the consideration of a more recent data would have allowed to find a more significant markup effect on households welfare. The second limitation of this study is the uniform introduction of productivity effect throughout all the sectors of the model. An estimation of the differentiated productivities elasticities for each main sector would allow to better capture the distributive effect linked to services liberalization.

Despite these weaknesses, some interesting policy recommendations can be drawn from our study. More specifically, reforms in telecommunications sector should be a full part of a national strategy of fight against poverty. Our results advocate for the attribution of a third mobile license in Cameroonian telecommunications market. A strong pro-competitive

telecommunications regulation will be in the long term the main means to realize supplementary gains from telecommunications. This advocates for the strengthening of national regulatory operator in order to follow the best regulatory practice at international level.

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ANNEXES

Annex. I CGE and households model results of main model

Table AI-1. Final consumption, investment and intermediate consumptions prices

		Base line	Markup effect: (elast 15)	Productivity effect: (elast 15)	Productivity + markup effect: elast 15	Markup effetct (elast 100)	productivity + markup effect (elast 100)
Sectors categories	sectors	Base line	change	change	change	change	change
Formal sector Intermediate prices	Other business Services	1.06	-0.14	0.21	0.07	-0.76	-0.55
	Food Agriculture	1.02	-0.01	0.22	0.21	-0.02	0.20
	Agriculture of exportations	1.04	-0.06	0.34	0.28	-0.31	0.03
	Industry	1.04	-0.01	0.28	0.27	-0.07	0.22
	Publics and social services	1.06	-0.16	0.25	0.09	-0.88	-0.63
	Transportations	1.07	-0.20	0.23	0.03	-1.11	-0.89
	Telecommunications	1.07	-0.36	0.28	-0.08	-1.97	-1.70
	Finances	1.11	-0.26	0.17	-0.09	-1.42	-1.25
Informal sector Intermediate prices	Other business Services	1.05	-0.14	0.20	0.06	-0.79	-0.59
	Food Agriculture	1.02	-0.01	0.22	0.21	-0.02	0.20
	Agriculture of exportations	1.04	-0.06	0.34	0.28	-0.31	0.03
	Industry	1.03	-0.01	0.29	0.28	-0.06	0.23
	Publics and social services	1.06	-0.16	0.25	0.09	-0.88	-0.63
	Transportations	1.07	-0.20	0.23	0.03	-1.11	-0.89
	Telecommunications	0.00	0.00	0.00	0.00	0.00	0.00
	Finances	0.00	0.00	0.00	0.00	0.00	0.00
Investments	Other business Services	343711.00	-0.14	7.84	7.69	-0.94	6.86
	Food Agriculture	479598.00	-0.14	7.84	7.69	-0.94	6.86
	Agriculture of exportations	73365.00	-0.14	7.84	7.69	-0.94	6.86
	Industry	597833.00	-0.14	7.84	7.69	-0.94	6.86
	Publics and social services	-145333.00	-0.14	7.84	7.69	-0.94	6.86
	Transportations	-219757.00	-0.14	7.84	7.69	-0.94	6.86
	Telecommunications	-46898.00	-0.14	7.84	7.69	-0.94	6.86
	Finances	28182.00	-0.14	7.84	7.69	-0.94	6.86
Final consumption	Other business Services	1000544.85	0.04	4.59	4.63	0.21	4.82
	Food Agriculture	1608992.91	0.00	1.13	1.13	0.00	1.13
	Agriculture of exportations	54728.81	0.02	1.06	1.07	0.09	1.15
	Industry	1286060.96	0.01	2.06	2.06	0.04	2.09
	Publics and social services	376334.50	-0.08	9.07	8.99	-0.57	8.49
	Transportations	381768.01	0.04	5.24	5.28	0.16	5.41
	Telecommunications	56315.54	4.82	5.27	10.29	31.20	37.72
	Finances	5249.51	0.24	5.02	5.28	1.30	6.38

Source: Author estimations

Table AI-2. Poverty indicator by category of households

			FGT-0		FGT-1		FGT-2	
		(0)	(1)	(2)	(3)	(4)	(5)	(6)
			Reference	change	Reference	change	Reference	change
	Formal	Rural not qualified formal	0.40	2.63	0.16	5.00	0.08	5.25
		Urban not qualified formal	0.28	1.89	0.08	10.25	0.03	12.67
		rural qualified formal	0.22	1.74	0.06	6.83	0.02	8.50
		Urban qualified formal	0.07	1.48	0.01	19.00	0.00	0.05
	Informal	Rural not qualified informal	0.60	2.07	0.20	5.35	0.09	6.67
		Urban not qualified informal	0.37	2.92	0.10	12.40	0.04	16.00
		rural qualified informal	0.51	1.35	0.17	3.76	0.08	4.63
		Urban qualified informal	0.17	1.96	0.04	13.00	0.01	20.00
	Inactive	Rural inactive	0.51	1.95	0.17	2.94	0.08	3.25
Simulation 1		Urban inactive	0.21	0.07	0.05	4.60	0.02	5.00
	Formal	Rural not qualified formal	0.40	0.19	0.16	0.38	0.08	0.38
		Urban not qualified formal	0.28	0.00	0.08	0.50	0.03	0.67
		rural qualified formal	0.22	0.00	0.06	0.50	0.02	0.50
		Urban qualified formal	0.07	0.16	0.01	2.00	0.00	0.01
	Informal	Rural not qualified informal	0.60	0.06	0.20	0.20	0.09	0.22
		Urban not qualified informal	0.37	0.02	0.10	0.30	0.04	0.50
		rural qualified informal	0.51	0.11	0.17	0.18	0.08	0.13
		Urban qualified informal	0.17	0.00	0.04	0.50	0.01	1.00
	Inactive	Rural inactive	0.51	0.00	0.17	0.18	0.08	0.25
Simulation 2		Urban inactive	0.21	0.00	0.05	0.20	0.02	0.50
	Formal	Rural not qualified formal	0.40	2.63	0.16	4.81	0.08	5.00
		Urban not qualified formal	0.28	1.89	0.08	9.75	0.03	12.00
		rural qualified formal	0.22	1.74	0.06	6.50	0.02	8.50
		Urban qualified formal	0.07	1.48	0.01	19.00	0.00	0.05
	Informal	Rural not qualified informal	0.60	2.03	0.20	5.15	0.09	6.56
		Urban not qualified informal	0.37	2.92	0.10	12.10	0.04	15.75
		rural qualified informal	0.51	1.37	0.17	3.65	0.08	4.38
		Urban qualified informal	0.17	1.75	0.04	12.50	0.01	20.00
	Inactive	Rural inactive	0.51	1.56	0.17	2.82	0.08	3.00
Simulation 3		Urban inactive	0.21	0.05	0.05	4.20	0.02	4.50
	formal	Rural not qualified formal	0.40	2.63	0.16	6.00	0.08	6.50
		Urban not qualified formal	0.28	1.93	0.08	12.38	0.03	14.67
		rural qualified formal	0.22	1.92	0.06	8.50	0.02	11.00
		Urban qualified formal	0.07	1.78	0.01	23.00	0.00	0.06
	Informal	Rural not qualified informal	0.60	2.34	0.20	6.05	0.09	7.56
		Urban not qualified informal	0.37	3.33	0.10	13.50	0.04	17.50
		rural qualified informal	0.51	1.59	0.17	4.41	0.08	5.38
		Urban qualified informal	0.17	2.08	0.04	14.25	0.01	22.00
	Inactive	Rural inactive	0.51	2.55	0.17	3.59	0.08	4.00
Simulation 4		Urban inactive	0.21	0.32	0.05	5.60	0.02	6.00

Source: Author estimations

Table AI-3. Variety effect simulations

variables		Baseline	Variety effect without markup	Variety effect with markup 15%	Variety effect without markup 100%
Macro indicators	Households	5329957.02	0.63	0.63	0.65
	Firm revenue	1946772.00	-0.07	-0.08	-0.13
	Goverment revenu	1509982.00	-0.12	-0.12	-0.14
	CPI	1.02	-0.15	-0.15	-0.14
	GDP	6259528.00	0.17	0.17	0.17
Production	Other business Services	3139768.00	0.11	0.11	0.11
	Food Agriculture	2934049.00	0.22	0.22	0.22
	Agriculture of exportations	463327.00	0.10	0.09	0.08
	Industry	3915240.00	0.01	0.01	0.00
	Publics and social services	906059.00	0.69	0.69	0.69
	Transportations	572331.00	0.55	0.56	0.57
	Telecommunications	367000.39	3.49	3.54	3.82
	Finances	114205.58	2.11	2.12	2.19
Composite prices	Other business Services	1.01	-0.12	-0.12	-0.11
	Food Agriculture	1.01	0.45	0.46	0.49
	Agriculture of exportations	1.01	-0.01	-0.01	0.01
	Industry	1.06	0.17	0.18	0.20
	Publics and social services	1.01	-0.28	-0.28	-0.26
	Transportations	1.06	-0.63	-0.63	-0.63
	Telecommunications	0.41	-36.55	-36.78	-38.09
	Finances	1.14	-2.40	-2.41	-2.47
Formal sectors wages	Wage of rural non qualified in formal activity	1.80	0.36	0.37	0.42
	Wage of rural qualified in formal activity	1.83	0.33	0.34	0.39
	Wage of urban non qualified in formal activity	2.35	0.36	0.37	0.42
	Wage of urban qualified in formal activity	3.16	0.33	0.34	0.39
Informal sector wages	Wage of rural non qualified in informal activity	0.50	0.92	0.93	0.97
	Wage of rural qualified in informal activity	1.25	0.92	0.93	0.97
	Wage of urban non qualified in informal activity	1.50	0.92	0.93	0.97
	Wage of urban qualified in informal activity	2.50	0.92	0.93	0.97
Formal sector capital return	Other business Services	4.00	1.00	1.01	1.07
	Food Agriculture	4.00	0.89	0.90	0.95
	Agriculture of exportations	4.00	0.80	0.80	0.82
	Industry	4.00	0.53	0.53	0.55
	Publics and social services	4.00	0.84	0.85	0.90
	Transportations	4.00	1.06	1.07	1.14
	Telecommunications	4.00	-9.91	-9.85	-9.52
	Finances	4.00	1.34	1.35	1.44
Informal sector capital return	Other business Services	3.00	0.77	0.78	0.82
	Food Agriculture	3.00	1.03	1.04	1.08
	Agriculture of exportations	3.00	0.90	0.91	0.94
	Industry	3.00	0.84	0.85	0.88
	Publics and social services	3.00	0.97	0.98	1.03
	Transportations	3.00	1.15	1.16	1.22
	Telecommunications	3.00	0.00	0.00	0.00
	Finances	3.00	0.00	0.00	0.00

Source: Author estimations

Table AI-4. Results of alternatives closures rules (sensitivity analysis)

		Baseline	current account endogenous and investment exogenous	government Consumption endogenous and government saving exogenous	Labor supply endogenous and wage exogenous	capital endogenous and capital price exogenous	IPC exogenous and TCN endogenous
		(1)	(2)	(3)	(4)	(5)	(6)
Macro indicators	Households income	5237311	3.3	3.3	5.8	9.1	3.2
	IPC	1	-1.5	0.4	-0.7	1.7	0.0
	GDP	6345194	3.4	3.4	6.2	10.1	3.4
	Firms revenue	1946772	2.1	3.8	5.4	12.9	3.5
	Gov revenue	1509982	2.1	3.8	5.8	12.8	3.6
production	Other business	3139768	3.9	3.8	7.5	12.9	4.1
	Food Agriculture	2934049	1.9	1.9	5.1	7.3	2.7
	Agriculture of	463327	3.9	2.8	6.2	12.7	3.7
	Industry	3915240	3.8	3.2	5.7	12.6	3.6
	Publics and social	906059	3.6	5.9	6.2	3.2	2.6
	Transportations	572331	4.9	4.3	5.8	6.4	2.9
	Telecommunications	99399	6.5	6.1	7.5	11.5	5.1
	Finances	113683	3.6	3.1	9.3	12.6	4.8
Prices	Other business	1	-1.4	0.5	-0.3	1.7	0.3
	Food Agriculture	1	-2.0	-0.2	-1.8	3.1	-0.1
	Agriculture of	1	-2.0	-0.1	0.8	1.3	0.5
	Industry	1	-1.2	0.3	0.7	0.6	0.3
	Publics and social	1	-0.9	2.6	-1.6	2.2	-0.3
	Transportations	1	-0.8	1.3	-1.1	1.6	-0.3
	Telecommunications	1	-3.0	-0.7	-2.9	-4.6	-3.3
	Finances	1	-1.1	1.3	-1.8	2.9	-0.2
Formal sector Wages	WRUNQ1	2	2.6	6.0	0.0	10.0	3.4
	WRUQ1	2	2.7	6.1	0.0	9.5	3.3
	WURNQ1	2	2.6	6.0	0.0	10.0	3.4
	WURQ1	3	2.7	6.1	0.0	9.5	3.3
Informal sector wages	WRUNQ2	1	1.2	3.0	0.0	11.9	3.4
	WRUQ2	1	1.2	3.0	0.0	11.9	3.4
	WURNQ2	2	1.2	3.0	0.0	11.9	3.4
	WURQ2	3	1.2	3.0	0.0	11.9	3.4
Formal sector wages	Other business	4	2.3	4.5	6.4	0.0	4.6
	Food Agriculture	4	-0.4	1.6	2.1	0.0	2.5
	Agriculture of	4	3.0	2.4	7.0	0.0	4.1
	Industry	4	3.1	3.5	7.4	0.0	4.0
	Publics and social	4	2.8	9.2	3.3	0.0	2.3
	Transportations	4	4.3	6.0	3.7	0.0	2.6
	Telecommunications	4	10.8	13.4	10.7	0.0	7.7
	Finances	4	2.8	5.8	4.7	0.0	4.5
Informal sector wages	Other business	3	2.4	4.5	6.6	0.0	4.5
	Food Agriculture	3	-0.4	1.5	2.0	0.0	2.5
	Agriculture of	3	2.7	2.3	6.1	0.0	4.0
	Industry	3	2.7	3.1	6.1	0.0	3.9
	Publics and social	3	3.0	9.7	3.4	0.0	2.3
	Transportations	3	4.3	5.9	3.7	0.0	2.6
	Telecommunications	3	0.0	0.0	0.0	0.0	0.0
	Finances	3	0.0	0.0	0.0	0.0	0.0

Source: Author estimations

Annex II. SAM and Calibration

Box1: Workers revenue estimation (Heckman model)

Given that the estimation is based only on individual data for those who work, we correct for selection bias by using the model of Heckman. The Heckman correction takes place in two stages:

First stage

We estimate a model of selection to predict the probability of working for each individual. In this stage, we assume that each individual at working age must make a choice to get into labor market or not (status-quo). This choice is made on the basis of the criteria, S^*_{mi}, that we assume as being a linear function of, z_{mi}, the individuals (i) and households (h) characteristics. It is formulated as $S^*_{mi} = c_{h(mi)} + z_{mi} d_{h(mi)} + \pi_{mi}$ where d_{mi} is the vector of observables determinants of criteria while c_{mi} and π_{mi} the intercept and the residue capturing the unobservable determinants. We assume that the criteria take the value zero in the case of status-quo (S^*_{mi}=0).

Let S_{mi} be a dummy variable taking the value 1 when the individual decide to get into the work market and zero otherwise.

$$S_{mi} = \begin{cases} =1 & if \quad c_{mi} + z_{mi} d_{mi} + \pi_{mi} > 0 \\ =0 & \sin on \end{cases}$$

The probability of choosing S_{mi} is estimated through a probit model using the maximum likelihood

.

Second stage,

In the second stage, we estimate the wage (in a statistically appropriate way) by correcting for self-selection through the incorporation of predicted individual probabilities (say mills ratio) as an additional explanatory variable, along with individual (sector and industry, age, gender, education level, marital status) and households (size, place of residence) characteristics. Here below (table AII-1) is the result of estimations from this stage.

Table AII-1. Estimations of microeconomic revenues

	(1)	(2)
	Qualified wage	**Non qualified wage**
Age	0.025	-0.000
	(15.87)***	(0.35)
Education	0.087	-0.015
	(15.37)***	(1.97)**
working Days per week	0.069	0.063
	(5.46)***	(4.28)***
Department	-0.002	0.009
	(1.63)	(5.47)***
Gender	-0.286	-0.477
	(9.39)***	(11.13)***
Poor health	-0.048	-0.000
	(3.12)***	(0.02)
Region (city Vs village)	-0.258	-0.298
	(11.26)***	(10.10)***
Sector Para public	-0.240	-0.091
	(3.08)***	(0.46)
Sector Private formal	-0.480	-0.225
	(10.87)***	(1.59)
Sector Informal agricultural	-1.373	-0.760
	(24.28)***	(5.87)***
Sector Informal nonagricultural	-0.959	-0.684
	(21.99)***	(5.35)***
Number spouse	0.075	-0.284
	(2.05)**	(0.88)
Household Size	0.647	0.844
	(4.52)***	(2.19)**
Constant	5.415	6.621
	(36.36)***	(32.93)***
Observations	7328	6679
R-squared	0.55	0.48

Robust t statistics in parentheses * significant at 10%; ** significant at 5%; *** significant at 1%

Table AII-2. Introduction of new services or new technologies in Cameroonian telecommunications market between 1999 and 2007

Segments		1999	2000	2001	2002	2003	2004	2005	2006	2007	Total
Internet	number	2	4	0	4	1	1	2	0	2	16
	Services or technologies	-Connection RTC -"Liaison cable"	-Connexion - Wireless -Telephony (Voice IP) -Net fax -VPN	Improvmment in existing product	-Web Design -Web Hosting -Domain Name -Webcam, Visio Conference	- V-SAT Connection	- WIFI Connection	- U-SAT -ADSL Connection	Improvmment in existing product	-WAP (Internet through Cellular) -Possibility of connection through optical fiber	
fixe telephone	number	0	0	0	1	0	0	1		0	2
	Services or technologies	Urban and interurban telephony	RAS	RAS	Schiff to Numbers with 7 digits	RAS	RAS	Entry in the market in December of CTPHONE based on CDMA technology (In fact CTPHONE is a bridge between the fixed and mobile, since it allows the movement within a radius of 50 km to the round)	RAS	RAS	
mobile telephone	number	0	2	0	2	0	5	3	0	1	14
	Services or technologies	RAS	- Urban, interurban and international telephony -SMS	RAS	-management of double calls - conférence max 5 Calls	RAS	-Pay as you GO POP -Pay as you GO PER Second -Pay as you GO GOLD -Business Solutions Flexi -Me2U transfert de crédit	-GPS Localisation - Roaming -CSD DATA Link Data transfer	RAS	WAP (Internet through Cellular)	

Sources : collected by the author from different sources including (Cameroonian regulation authority of telecommunication website, Internet cafés, and telephone box owners in Yaoundé)

Note: RAS= no inovation

Table AII-3. Social Accounting Matrix of Cameroon in 2001

		RURTNQ	**URBTNQ**	**RURTQ**	**URBTQ**	**CAP**	**TER**	**MNAGE**	**ENTR**	**ETAT**	**RDM**	**TAXREV**	**TAXACT**	**TVA LCX**	**TAXDOM**	**TVA IMP**	**TAXVTE**	**Tarif**	**TAX exprt**	**AGR VRIER-**	**AGRV RIER-**	**AGREXP-FOR**	**AGR EXP-INF**	**IND-FOR**	**IND-INF**	**SEVSO-FOR**	**SEVSO-INF**
	Nunéros	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
RURTNQ	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3963	226746	663	12509	5594	56183	14851	1460
URBTNQ	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7055	403103	1173	22238	9944	99881	26402	2596
RURTQ	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	19842	70858	3314	3903	27968	17558	74254	457
URBTQ	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	79366	283432	13255	15636	111870	70229	297008	1825
CAP	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	129986	358443	84341	35181	1002977	140574	201991	1247
TER	6	**0**	**0**	**0**	**0**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6442	17767	8998	3753	0	0	0	0
MNAGE	7	534018	949366	346545	1386179	1023248	36960	0	714386	408514	10400	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ENTR	8	0	0	0	0	1946772	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ETAT	9	0	0	0	0	172043	0	0	371689	0	0	399718	33507	168663	98805	115478	145200	0	4879	0	0	0	0	0	0	0	0
RDM	10	0	0	0	0	0	0	0	69360	197347	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TAXREV	11	0	0	0	0	0	0	168761	230957	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TAXACT	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	355	1957	376	313	3289	2041	756	10
TVA LCX	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TAXDOM	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TVA IMP	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TAXVTE	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tarif	17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TAX exprt	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AGRVRIER-FOR	19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AGRVRIER-INF	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AGREXP-FOR	21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AGREXP-INF	22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
IND-FOR	23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
IND-INF	24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SEVSO-FOR	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SEVSO-INF	26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TRANS-FOR	27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TRANS-INF	28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TELCOM-FOR	29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TELCOM-INF	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FINCE-FOR	31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SEVTRDE-FOR	32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SEVTRDE-INF	33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AGRVRIER-C	34	0	0	0	0	0	0	1616363	0	0	0	0	0	0	0	0	0	0	0	71096	392096	1817	1515	138942	102939	8578	106
AGREXP-C	35	0	0	0	0	0	0	55458	0	0	0	0	0	0	0	0	0	0	0	4143	22845	28462	23744	41206	30534	108	2
IND-C	36	0	0	0	0	0	0	1357395	0	0	0	0	0	0	0	0	0	0	0	20780	114599	50907	42469	726972	293099	131987	1623
SEVSO-C	37	0	0	0	0	0	0	378204	0	660749	0	0	0	0	0	0	0	0	0	68	375	90	76	1757	1185	984	13
TRANS-C	38	0	0	0	0	0	0	402892	0	0	0	0	0	0	0	0	0	0	0	27844	153559	6698	5588	54359	25546	20259	250
TELCOM-C	39	0	0	0	0	0	0	81221	0	0	0	0	0	0	0	0	0	0	0	476	2622	2388	1992	6741	3056	14797	183
FINCE-C	40	0	0	0	0	0	0	5966	0	0	0	0	0	0	0	0	0	0	0	358	1969	766	639	7110	2523	6803	84
SEVTRDE-C	41	0	0	0	0	0	0	1013370	0	0	0	0	0	0	0	0	0	0	0	78927	435289	49727	41485	580582	355911	96994	1197
AGRVRIER	42	0	0	0	0	0	0	0	0	0	45837	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AGREXP	43	0	0	0	0	0	0	0	0	0	201799	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
IND	44	0	0	0	0	0	0	0	0	0	1246178	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TRANS	45	0	0	0	0	0	0	0	0	0	112268	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TELCOM	46	0	0	0	0	0	0	0	0	0	4445	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FINCE	47	0	0	0	0	0	0	0	0	0	28608	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SEVTRDE	48	0	0	0	0	0	0	0	0	0	71076	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ACCUM	49	0	0	0	0	0	0	329986	560380	243372	-23037	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	50	**534018**	**949366**	**346545**	**1386179**	**3142063**	**36960**	**5409616**	**1946772**	**1509982**	**1697574**	**399718**	**33507**	**168663**	**98805**	**115478**	**145200**	**0**	**4879**	**450701**	**2485660**	**252975**	**211041**	**2719311**	**1201259**	**895772**	**11053**

		TRANS-FOR	**TRANS-INF**	**TELCOM-FOR**	**TELCOM-INF**	**FINCE-FOR**	**SEVTRDE-FOR**	**SEVTRDE-INF**	AGRVRIER-C	AGREXP-C	IND-C	SEVSO-C	TRANS-C	TELCOM-C	FINCE-C	**SEVTRDE-C**	**AGRVRIER**	**AGREXP**	**IND**	**TRANS**	**TELCOM**	**FINCE**	**SEVTRDE**	**ACCUM**	**Total**
	Nunéros	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	**50**
RURTNQ	1	3184	20202	606	68	1125	13920	172944	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**534018**
URBTNQ	2	5659	35914	1077	121	2000	24747	307456	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**949366**
RURTQ	3	15916	6313	3028	22	5625	43442	54045	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**346545**
URBTQ	4	63664	25252	12112	85	22498	173767	216180	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**1386179**
CAP	5	124956	36303	76032	205	10999	539309	399519	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**3142063**
TER	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**36960**
MNAGE	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**5409616**
ENTR	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**1946772**
ETAT	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**1509982**
RDM	10	0	0	0	0	0	0	0	153457	21806	1051204	0	58594	5469	34824	105513	0	0	0	0	0	0	0	0	**1697574**
TAXREV	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**399718**
TAXACT	12	5497	3194	456	3	0	6375	8885	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**33507**
TVA LCX	13	0	0	0	0	0	0	0	1804	909	94391	3735	22665	10211	8639	26309	0	0	0	0	0	0	0	0	**168663**
TAXDOM	14	0	0	0	0	0	0	0	6360	0	92445	0	0	0	0	0	0	0	0	0	0	0	0	0	**98805**
TVA IMP	15	0	0	0	0	0	0	0	4213	2465	108800	0	0	0	0	0	0	0	0	0	0	0	0	0	**115478**
TAXVTE	16	0	0	0	0	0	0	0	26605	1907	116688	0	0	0	0	0	0	0	0	0	0	0	0	0	**145200**
Tarif	17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
TAX exprt	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1775	5	3099	0	0	0	0	0	**4879**
AGRVRIER-FOR	19	0	0	0	0	0	0	0	443938	0	0	0	0	0	0	0	6763	0	0	0	0	0	0	0	**450701**
AGRVRIER-INF	20	0	0	0	0	0	0	0	2448361	0	0	0	0	0	0	0	37299	0	0	0	0	0	0	0	**2485660**
AGREXP-FOR	21	0	0	0	0	0	0	0	0	142960	0	0	0	0	0	0	0	110015	0	0	0	0	0	0	**252975**
AGREXP-INF	22	0	0	0	0	0	0	0	0	119262	0	0	0	0	0	0	0	91779	0	0	0	0	0	0	**211041**
IND-FOR	23	0	0	0	0	0	0	0	0	0	1656459	0	0	0	0	0	0	0	1062852	0	0	0	0	0	**2719311**
IND-INF	24	0	0	0	0	0	0	0	0	0	1021032	0	0	0	0	0	0	0	180227	0	0	0	0	0	**1201259**
SEVSO-FOR	25	0	0	0	0	0	0	0	0	0	0	895772	0	0	0	0	0	0	0	0	0	0	0	0	**895772**
SEVSO-INF	26	0	0	0	0	0	0	0	0	0	0	11053	0	0	0	0	0	0	0	0	0	0	0	0	**11053**
TRANS-FOR	27	0	0	0	0	0	0	0	0	0	0	0	296484	0	0	0	0	0	0	71009	0	0	0	0	**367493**
TRANS-INF	28	0	0	0	0	0	0	0	0	0	0	0	172270	0	0	0	0	0	0	41259	0	0	0	0	**213529**
TELCOM-FOR	29	0	0	0	0	0	0	0	0	0	0	0	0	134229	0	0	0	0	0	0	4421	0	0	0	**138650**
TELCOM-INF	30	0	0	0	0	0	0	0	0	0	0	0	0	722	0	0	0	0	0	0	24	0	0	0	**746**
FINCE-FOR	31	0	0	0	0	0	0	0	0	0	0	0	0	0	96008	0	0	0	0	0	0	28608	0	0	**124616**
SEVTRDE-FOR	32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1359177	0	0	0	0	0	0	65535	0	**1424712**
SEVTRDE-INF	33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1724775	0	0	0	0	0	0	5541	0	**1730316**
AGRVRIER-C	34	37	22	0	0	10	99841	171778	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	479598	**3084738**
AGREXP-C	35	0	0	0	0	0	2864	6578	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	73365	**289309**
IND-C	36	82690	48047	11322	61	4418	369916	286901	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	597833	**4141019**
SEVSO-C	37	2358	1364	52	1	138	3948	4531	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-145333	**910560**
TRANS-C	38	4536	2638	1395	8	2572	41636	19990	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-219757	**550013**
TELCOM-C	39	9434	5482	5370	29	4908	30041	28789	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-46898	**150631**
FINCE-C	40	17994	10456	879	5	48708	3659	3370	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	28182	**139471**
SEVTRDE-C	41	31568	18342	26321	138	21615	71247	49350	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	343711	**3215774**
AGRVRIER	42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**45837**
AGREXP	43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**201799**
IND	44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**1246178**
TRANS	45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**112268**
TELCOM	46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**4445**
FINCE	47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**28608**
SEVTRDE	48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**71076**
ACCUM	49	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**1110701**
Total	50	**367493**	**213529**	**138650**	**746**	**124616**	**1424712**	**1730316**	**3084738**	**289309**	**4141019**	**910560**	**550013**	**150631**	**139471**	**3215774**	**45837**	**201799**	**1246178**	**112268**	**4445**	**28608**	**71076**	**1110701**	

Source: Author construction from original SAM provided by Emini (2004)

Table AII-4. Correspondences between Sam sectors and ECAM II products nomenclature

Sectors in the SAM	Activities nomenclature in ECAMII
Food Agriculture	Agri/Pêche/Chasse
	Elevage
Agriculture of exportations	Agri/Pêche/Chasse
	Elevage
Industry	Mines et Minerais
	Energie/Gaz/Eau
	Industrie Agro Ali
	Industrie Textile
	Industrie de Bois
	Industrie Chimique
	Ind. Matériaux de Construction
	Métaux Mécanique et Réparation
Finances	Banque / Assurance
Transportations	Transport et communication
Telecommunications	Transport et communication
Other business Services	BTP
	Commerce Général
	Commerce Alimentaire Spécialisé
	Autre Commerce
	Hôtellerie et Restauration
Publics and social services	Services Publiques
	Autres Services sociaux

Source : Author construction

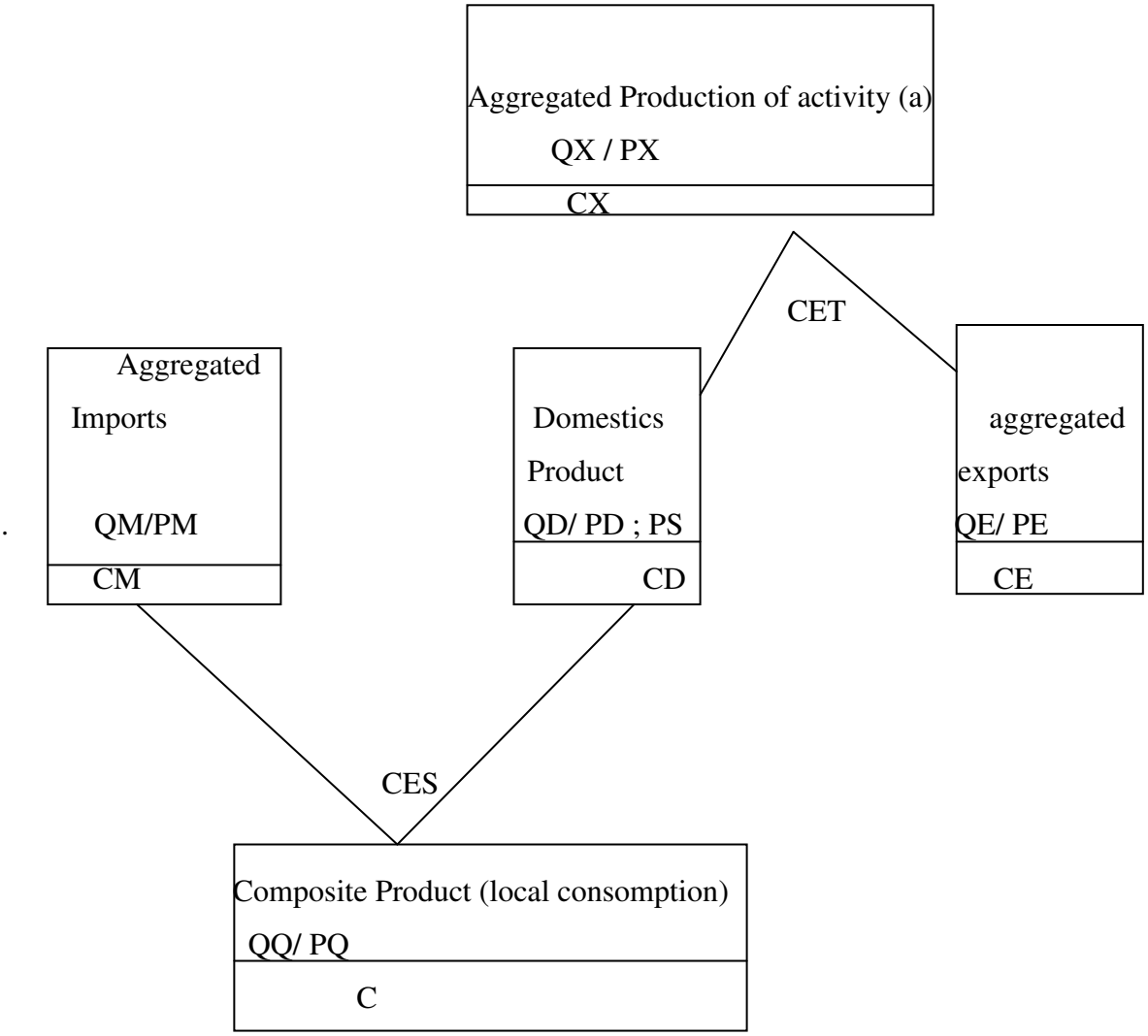
Table AII-5. Correspondences between SAM sectors and ECAM II nomenclature of expenditures

Sectors of the SAM	**Corresponding expenditure account in ECAMII**
Food Agriculture	Dépenses d'alimentation, autoconsommation, boisson et tabacs
Agriculture of exportations	Dépenses d'alimentation, autoconsommation, boisson et tabacs
Industry	Dépenses logements, eau, électricité, gaz et autres combustibles
	Dépenses d'habillement, équipements de maison, hôtels
Other business Services	Dépenses de transport et communication
finance	Dépenses de transport et communication
Transportations	Dépenses de transport et communication
Telecommunications	Dépenses de transport et communication
Other business Services	Dépenses d'éducation, santé, loisir, spectacles et culture

Source : Author construction

ANNEX.III : CGE model

Figure AIII-1. Allocations of consumptions and the domestic production



ANNEX. IV: Presentation of CGE model: (available on request)

RESUME

Cette thèse analyse les effets d'une libéralisation du commerce de services en Afrique. Au-delà d'un chapitre introductif (chapitre 1), la thèse contient trois chapitres: le chapitre 2 analyse les déterminants du pouvoir de marché dans le secteur des télécommunications. Le troisième étudie l'impact du commerce des services sur la croissance économique en mettant l'accent sur les services de télécommunications et de finances. Le quatrième procède à la simulation de l'impact de la libéralisation des services sur la pauvreté en s'appuyant sur le cas des télécommunications au Cameroun.

Les chapitres 2 et 3 sont basés sur des données agrégées de 30 pays africains entre 1997 et 2004. Ils s'appuient sur les modèles structurels et utilisent les estimations du 3SLS. Leurs principales conclusions empiriques sont les suivantes: (i) Concernant les télécommunications, l'industrie africaine est confrontée à un fort pouvoir de marché. Trois facteurs politiques semblent avoir une incidence négative sur le pouvoir de marché: les efforts unilatéraux, en termes de libéralisation (en nombre d'opérateurs) et de renforcement de la réglementation sectorielle, aussi bien que les engagements multilatéraux à libéraliser dans le cadre de l'AGCS. Toutefois, il apparaît que l'effet des contacts multi-marchés des opérateurs de télécommunications est un important facteur de renforcement des comportements de coopération et de collusion. (ii) En ce qui concerne l'effet sur la croissance, le niveau de la concurrence a un effet important sur l'accès aux services de télécommunications, qui à son tour, influence de manière significative la croissance des revenus. (iii) Dans le cas du secteur financier, la libéralisation du commerce s'avère être un important déterminant de la structure du marché, mesurée par le niveau de concentration, tandis que les indicateurs de performances sectorielles (crédit au secteur privé) apparaissent comme d'importants déterminants de la croissance.

Le quatrième chapitre utilise les elasticités déterminées dans les deux précédents et adopte l'approche de micro-macro simulation pour analyser la pauvreté (Shen et Ravallion, 2004). Il se base sur la MCS camerounaise de 2001 et sur l'enquête sur les revenus de ménages camerounais en 2001 (ECAM II). Les résultats montrent que la libéralisation des télécommunications contribue à réduire la pauvreté au Cameroun, l'essentiel des gains étant généré par les effets de productivité.

ABSTRACT

This thesis assesses the impact of services trade liberalization in Africa. Beyond an introductive chapter (chapter1), the thesis contains three chapters: the chapter 2 assesses the determinant of market power in telecommunications industry. The third analyses the impact of service trade on economic growth focusing on the services of telecommunications and finances. The fourth proceed to the simulation of service liberalization impact on poverty relying on the case of telecommunication in Cameroon.

The chapters 2 and 3 are based on aggregated data from 30 African countries between 1997 and 2004. Relying on structural models and using the 3SLS estimates, three sets of results emerge from our empirical analysis: (i) Concerning the telecommunications, the African industry faces significant market power practices: Three policy factors seem to be affecting negatively this market power: the unilateral efforts in terms of liberalization (increasing in number of operators) as well as strengthening of sectoral regulation, and the multilateral commitments to liberalize in the framework of the GATS. However, it appears that multimarket contact of telecommunications operators is an important factor enhancing the cooperative pricing behavior. (ii) Regarding the growth effect of services liberalization, the level of competition has a strong effect on telecommunications services accessibility, which in turn influences the income growth. (iii) In the case of financial sector, the services trade liberalization (openness) emerges to be a strong determinant of market structures, while the sectoral performances indicators (credit to private and spread) emerge as strong determinants of income growth.

The chapter 4 uses the elasticities estimated in the previous chapters and adopts the micro-macro simulation approach to analyze the poverty (Shen and Ravallion, 2004). It relies on Cameroonian SAM of 2001 and Cameroonian household's data of income survey for 2001 (ECAM II). Results show that liberalization of telecommunications contributes to reduce poverty in Cameroon, the main gain being generated by productivity effects.

Mots clés: Afrique, Cameroun, AGCS, Commerce des services, libéralisation, télécommunications, finances, pauvreté, croissance, pouvoir de marché, modèle d'équilibre générale Calculable (EGC), économétrie de modèles structurels, panel, triple moindre carré ordinaire, modèle MIMIC.